WATERSHED MANAGEMENT PRACTICES GUIDE FOR ACHIEVING SOIL AND WATER OBJECTIVES WALLOWA-WHITMAN NATIONAL FOREST

WATERSHED MANAGEMENT PRACTICES

GUIDE FOR ACHIEVING SOIL AND WATER OBJECTIVES

WALLOWA-WHITMAN NATIONAL FOREST
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INTRODUCTION

The watershed practices described in this document are designed to meet soil and water quality objectives of directly or indirectly maintaining or improving soil productivity and water quality by either preventing, abating or mitigating impacts while meeting other resource objectives.

These management practices, which have proven to be effective management tools, have been designed to achieve specific watershed objectives. The decision regarding implementing a practice as is or producing a new, equally effective one is dependent upon the time and expertise available for field analysis of watershed conditions. Management projects with high risk for changing watershed stability should have watershed specialist support -- soil/water scientists, district watershed representatives, or any other person experienced in a facet of watershed protection. This support will allow for possible practice modification based on site-specific observation and inventories. Lower watershed risk projects will not always receive the field support of watershed specialists -- their involvement then is through overview, consultation and broad planning. Thus for low risk projects, an efficient decision will often be to utilize management practices just as they are specified in this book.

Management practices in this book are just guides for appropriate action until they become integrated into implementation direction associated with specific projects. As mentioned above, these practices have proven to be effective management tools. This doesn't mean, however, that other practices cannot be employed when there is a high expectation of their meeting the associated watershed objective. If a different but equal or better practice can be developed to meet a specific objective then project designers are free to prescribe it.

The decision to modify or change a specific watershed management practice should be described in a document appropriate to the stage of project design or implementation -- for example, if still developing the EA, describe change there; or if project is being field implemented and the practice change does not contradict the EA, describe change in project administrator's notes. A section of this book is dedicated to the documentation of changes made to specific practices. Documentation of alternative practices is necessary to assist in the development of an acceptable range of practices which will meet (or not meet) specific watershed objectives.

The goal of this document is to provide the user with a concise guide to acceptable watershed management practices and at the same time provide supporting documentation and rationale. Feedback concerning document organization, content, practicality of recommendations, implementation problems or suggestions for improvement will be an ongoing process. This document will be updated as needed to conform with change in Forest Service policy, direction or as new information becomes available.

DOCUMENT FORMAT

This book contains two main sections. The first section contains a watershed management practices checklist and the second section contains documentation and more detailed recommendations.

The watershed practices checklist can be used in two main ways: First, this list should be used to verify that the appropriate practices are incorporated into planning documents; and second, this checklist can be used in contract preparation and administration to insure that Interdisciplinary Team (IDT) recommendations are implemented as intended.

The second section contains watershed practices documentation -- more detailed, specific recommendations, watershed objectives that practices were designed to achieve, and suggested/possible administration methods. The organization of this section follows that of the watershed management checklist in that practices are separated on the basis of management activities. The primary activity groups are: Sale Design, Sale Design and Administration in SMU's, Sale Administration, Road Management, Site Preparation, and Watershed Restoration.

WATERSHED PRACTICES
CHECKLIST

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
SALE DESIGN	UNIT DESIGN	**Timber harvest unit design. (Effects Analysis)**	To insure that unit design will secure favorable conditions of water flow and quality.	This is an administrative and preventive practice. Units are evaluated to estimate the response of the watersheds in the proposed sales.	17
	UNIT DESIGN	**Use of Erosion Hazard Ratings. (EHR's) B6.6, B6.65, B6.66**	To identify erosion hazard areas to avoid excessive land disturbance and associated stream water quality degradation.	This is a preventive practice. R-5 erosion hazard rating form should be used. (See appendix for copy of form)	17,89
	UNIT DESIGN	**Use of timber sale area maps for designating water quality protection needs. B1.1**	To identify protection areas & water sources for purchaser and TSA.	The following features should be included on sale area maps: Location & Class. of streams to be protected, wetlands, meadows, lakes potholes, water sources, etc. .	18
	UNIT DESIGN	**Protection of unstable areas. (IDT Recommendation)**	To provide special treatment of unstable areas to avoid triggering mass failures.	Unstable areas should be deferred where logging would result in unacceptable watershed damage.	18
	UNIT DESIGN	**Analyze peakflow cumulative effects (IDT recommendation)**	To provide for stable stream channels by minimizing peakflow changes -- both timing and quantity.	Analysis is based on existing condition and planned activities. This analysis is used to predict changes to peakflows.	19
	OPERATING PERIOD	**Limiting the operating period of timber sale activities.** C5.124, C5.232, B6.31, C6.315	To ensure that the purchaser conducts work operations, including erosion control work, road maintenance, etc., in a timely manner.	Should be used in environmentally sensitive areas or areas with high watershed values.	19, 35, 50
	HARVEST SYSTEMS	**Determining suitability of ground based logging systems.** C6.4 (opt.1), B6.5	To maintain soil productivity and water quality by minimizing ground disturbance.	Tractor logging is permitted on slopes of 30% or less if the EHR is 8 or less. With special specified mitigation and abatement prescriptions, and with tight admin -istrative control, ground based systems may be allowed when the EHR exceeds 8 or slopes exceed 30%.	19
	HARVEST SYSTEMS	**Ground skidding design; falling to lead and end lining of logs.** C6.4 (opt.1), B6.5 C6.4(opt. 1), B6.5, C6.3	Design skid trail patterns to best fit the terrain and minimize ground dedicated to transportation facilities.	This is a preventive practice. Watershed factors to consider are slope, EHR, exposure and proximity of streamside management units (SMU).	20

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
SALE DESIGN	LOG YARDING	**Suspension log yarding. B6.5, B6.65, C6.3 (opt. 1), C6.3 (opt.2), C6.42#, C6.43**	Minimize ground disturbance by requiring full or partial suspension log yarding.	Suspended log yarding includes all yarding systems which suspend logs either fully or partially off the ground. To be applied when EHR is 8 or greater, or when slopes are greater than 30%.	21
SALE DESIGN/ SALE ADMIN	SKIDDING	**Logging over 2' feet of snow or ground frozen to a depth of 4" or more. Skidding over frozen ground is the preferred method of operation. C6.46 (Opt.1), C6.46 (Opt.2)**	Minimize ground disturbance/soil compaction.	To allow for greater harvest flexibility skidding off designated trails may be allowed when there is 2 feet or more of snow or when the ground is frozen to a depth of 4 inches or more. Mid winter thaws will present a need to monitor harvest operations closely. If the snow or frozen conditions do not support the harvest equipment, skidding operations should be moved to a preapproved pattern and spacing as designated in the timber sale contract.	21
SALE DESIGN-KV	SPECIAL SITE PROTECTION MEASURES	**Special Erosion Prevention Measures C6.4, B6.5, C6.51, B6.65**	To provide appropriate erosion and sedimentation protection on disturbed areas.	This is an administrative and preventive treatment to be used on sales which contain special soil stabilization problems which are not expected to be taken care of by the normal methods prescribed under contract provisions. This treatment may include spreading of mulch on portions of roads, trails, landings or temporary fills.	21

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
WATERSHED MANAGEMENT PRACTICES WITHIN SMU'S	SMU's	**Streamside management unit (SMU's) widths. (IDT Determination)**	To designate a zone along streams and wetlands where prescriptions are made that will minimize the effects of nearby logging and related land disturbance activities.	The streamside management zone acts as an effective filter and absorptive zone for sediment; maintains shade; protects aquatic and terrestrial riparian habitats; protects channel and streambanks and promotes floodplain stability.	23
	SMU's	**Streamcourse Designation B6.5**	Provide a tool for communicating with the Purchaser.	Some streams require special protection.	23
	SMU's	**Pulling trees out of or across streamcourses. C6.3#(OPT1), C6.4, C6.41#, C6.51**	Maintain streambank stability and minimize slash accumulation in channels.	Direction of fall is away from the channel. Dragging trees across channels is to be limited. Specific requirements are based on stream class.	24
	SMU's	**Streamcourse Woody Debris B6.5, C6.51, C6.511#, C6.52**	To prevent channel erosion resulting from debris dams caused by logging slash and maintain natural instream large woody debris.	Specific recommendation is based on stream class.	26
	SMU's	**Future Replacement Logs for Channel**	To leave standing potential channel replacement logs to maintain dynamics and fish habitat.	For Class I, II & III streamcourses and poor stability IV's.	27
	SMU's	**Skidding Across Streamcourses B6.4, B6.5, B6.422**	Prevent or minimize sediment production resulting from skidding operations.	Specific recommendation is based on stream class.	27
	SMU's	**Riparian Management Zones and Stream Temperatures. B6.3, C6.3 (opt. 1)**	Maintain or improve existing stream temperatures. Maintain terrestrial wildlife habitat and maintain streambank stability	Specific recommendations are based on stream class and existing and planned conditions.	29
	SMU's	**Streamside Management Unit Bare Soil. C6.3 (opt.1), B6.422**	To minimize erosion and reduce stream sedimentation.	Extent of bare soil allowed is based on sideslope gradient.	32
	SMU's	**Site Prep & Prescribed Fires Within SMU's**	To maintain water quality and site productivity by minimizing bare soil conditions through maintenance of organic cover.	Same soil cover requirements as SMU bare soil recommendations above.	33

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
WATERSHED MANAGEMENT PRACTICES WITHIN SMU'S	SMU's	**Waterbarring within SMU's B6.6, B6.64, B6.65, C6.6# (OPT.1)**	Minimize erosion within SMU's.	Recommendations are based on Erosion Hazard Rating (EHR) and slope gradient.	33
	SMU'S	**SMU Erosion Control Timeliness C6.315, C5.232, C6.311 C5.1 (opt. 1)**	Reduce sedimentation risk by being more cautious during wet seasons and/or fish spawning or migration periods.	Aggressive erosion control including cessation of activities may be necessary. Decisions should be on conditions and stream class.	34

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	Goal	EXPLANATION	DOCUMENT LOCATION
SALE ADMIN.	LOG LANDINGS	**Designated Log Landing Location(s) B6.5, B6.63, B6.422, C6.3 C6.4(OPT.1)**	Minimize soil erosion and water quality impacts.	This is an administrative and preventive practice. Locate landings so that they can be winterized and properly drained. Avoid landing locations alongside or in meadows, dry or wet draws or other areas that cannot be drained or where excessive cuts and fills are necessary. Avoid areas where side-cast would reach meadows, drainages or other sensitive areas.	38
	EROSION CONTROL	**Timely erosion prevention and control. B6.5, B6.65**	Timely and adequate erosion control measures are required to minimize soil erosion and water quality degradation.	Erosion control work shall be kept current and the kind and intensity of control work should be adjusted to ground and weather conditions and the need for controlling runoff	38
	EROSION CONTROL	**Log Landing Erosion Prevention and Control. B6.5, B6.64, B6.65**	To reduce impacts of erosion and subsequent sedimentation by use of mitigating measures.	Provisions are to be made for the proper drainage and dispersion of water and for the revegetation of landings. Subsoiling of landings may be required.	38

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
SALE ADMIN.	EROSION CONTROL	**Erosion Control on Skid Trails and Firelines. B6.5, B6.65, B6.64**	Minimize erosion and protect water quality.	Location of all erosion control measures are to be designated on the ground or by written designation. Use guidelines for spacing and construction techniques and cross drain heights contained in documentations section of this report.	39
SALE ADMIN	EROSION CONTROL	**Maintenance of erosion control structures. B6.66**	To insure that erosion control structures are stabilized and working.	Erosion control structures are only effective when they are in good repair and stable condition. Once the erosion control structures are seeded there is the possibility that they may not become adequately vegetated or they may become damaged from subsequent activities.	41
	EROSION CONTROL	**Acceptance of erosion control measures before sale closure. B6.6**	To insure the adequacy of required erosion control measures prior to sale closure.	The effectiveness of soil erosion prevention and control is determined by the results found after sale areas have been exposed one or more years. A careful check is required before a timber sale is closed to assure that planned erosion work has been completed to the standard prescribed. An equally important inspection of older erosion work should be made. Inspections will help to determine the adequacy of the work, whether maintenance work is needed, and the practicality of the treatments used	39

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
SALE ADMIN.	SPECIAL SITE PROTECTION MEASURES	**Meadow Protection During Timber Harvest Operations. B6.61, C6.61#**	To avoid damage to ground cover, soil and water in meadows.	Unauthorized operation of vehicular or skidding equipment on meadows designated on sale area maps or on the ground is prohibited.	42
SALE ADMIN	CONTRACT PREP	**Non-Recurring C provisions to be used for soil productivity and water quality protection measures.**	Use special C provisions in Timber Sale contracts for areas where standard provisions do not apply or are inadequate to meet management objectives.	Special C provisions are sometimes needed to meet management objectives on a particular sale area. Examples include C 6.4 (opt. 3) subsoiling, swing yarding and directional falling requirements.	42
SALE ADMIN	CONTRACT CHANGES	**Modification of timber sale contracts. B8.32**	To modify timber sale contracts if new circumstances or conditions indicate that irreversible watershed damage will occur.	Modifications will need to be made if the sale as currently planned or implemented will result in irreversible soil, water or watershed conditions, or inadequately protect streams, streambanks, shorelines, lakes, wetlands or other bodies of water from detrimental changes in water temperatures, blockages of watercourses and deposits of sediment.	42

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	Goal	EXPLANATION	DOCUMENT LOCATION
ROAD MGT.	SMU's	**Temporary Roads-Stream Crossings.** B6.5, C5.1	To insure that temporary roads do not unduly damage streams or disturb channels & to insure that flow is unimpeded by structures.	Culverts or temporary bridges are required on temporary roads where it is necessary to cross designated streams. Other means of crossing flowing streams such as rock "turnpikes" and designated low water crossings may be required. All crossings should be approved by responsible official.	46
	SMU's	**Sensitive Construction Areas** C5.232 Specified Roads C6.311, C5.11(OPT 1 OR 2)	To protect Class I & II streams from sediment during construction activities.	Limits the amount of sediment generated by construction activities to 8 cubic yards of soil or less.	35, 46
	SMU's	**Surface Cross-Drain Spacing Guide.** B6.62	Minimize erosion and sedimentation by proper cross-drain spacing.	Guidelines are for other than GP/GW or crushed rock surfaces.	47
	SMU's	**Inside Ditch Sediment Catch Basins.**	Reduce risk of sedimentation.	To be used where inside ditches or other ditch relief culverts empty within 75 feet of streamcourses.	49
	SMU's	**Surface Cross-Drain Installation on New Construction and Reconstructed Roads.** (Road Design Specifications)	Minimize erosion and sedimentation during project life.	Proper surface cross-drains are prescribed whenever permanent roads are built.	48
	SMU's	**Surface Cross-Drain Installation on Temporary Roads.** C5.1, B6.62	Minimize erosion and sedimentation during project life.	As above except applies to temporary roads.	48
	SMU's	**Surface Cross-Drain Installation With Non-Reconstructed Existing Roads.** C5.42, C5.43	As above.	C-provision maintenance. Specifications are used to get properly designed cross-drains on existing roads.	49
	SMU's	**Limited Structural Strength Surface.** C5.124	To minimize road erosion & risk of sedimentation.	Prevent road damage and erosion and sedimentation by restricting use when damage is or is likely to occur. Also see Limiting Operating Period Recommendations.	50

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
ROAD MGT.	LOCATION & DESIGN	**Locate and design roads with minimal resource damage.**	To minimize soil and water damage by proper location and design of all system and temporary roads.	Road location and design considerations are preventive and include stream crossing considerations, slope considerations and coordination requirements.	45
	EROSION CONTROL	**Erosion Control Plans. CT6.311-Plan of Operation C5.43, C6.6#**	To limit and mitigate erosion and sedimentation through effective planning prior to initiation of construction activities and through effective contract administration during construction.	Land disturbing activities usually result in at least short term erosion. By effectively planning for erosion control sedimentation can be minimized.	52
	PIONEER ROAD CONTRUCTION	**Pioneer Road Construction Watershed Practices. B6.5, B6.65**	To minimize sediment production and mass wasting problems associated with pioneer road construction through timely completion.	Pioneer roads are built to allow equipment access for planned con-construction of roadways. Specific mitigation is required.	51
	MAINTENANCE	**Maintenance of roads to minimize erosion and sedimentation. C5.42, C5.43**	To maintain roads in a manner which provides for water quality protection by minimizing rutting, cut and fill slope failures and drainage blockages.	Road deterioration can be minimized through adequate maintenance and and restriction of use.	51
	WATER SOURCES	**Water source development consistent with water quality protection objectives. B1.1, B6.22**	To supply an adequate water source for for roads and fire protection while maintaining water quality.	Problems can arise when cofferdams or waterholes are built in streams. This process will create sediment problems during installation and removal. Cofferdams and waterholes should be built out of sandbags filled with clear sand or gravel. At no time should downstream water flow be reduced to a level that may be detrimental to aquatic resources fish passage or other established uses.	52

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
ROAD MGT.	TRAFFIC CONTROL	**Control traffic during wet periods. C5.232#-Critical Const.Area C5.124(OPT1)**	To reduce road surface disturbance and rutting of roads.	Unrestricted use of roads during wet weather often results in rutting and churning of the road surfaces. Runoff from such surfaces often carries a high sediment load. The damage created becomes a continuing sediment source.	52
	SNOW REMOVAL	**Snow removal controls to avoid resource damage. C5.43**	To minimize the impact of melt water on road surface and embankments and to reduce the probability of sediment production resulting from snow removal operations.	This is a preventive practice used to protect resources and water quality.	53
	CLOSURE/ OBLITERATION	**Closure or Obliteration of excess roads and trails.**	To reduce road surface disturbance and and sediment generated from roads not routinely maintained.	In order to prevent continued low level casual use.	53
ROAD MGT.	BORROW PITS/QUARRIES	**Restoration of borrow pits & quarries.**	To minimize sediment production from borrow pits and quarry sites.	Borrow pits and quarries are often susceptible to erosion due to steep slopes, lack of vegetation and/or their proximity to water courses.	54
ROAD MGT.	OPERATING PERIOD	**Road construction is to be limited to the normal operating period unless otherwise agreed to in writing. C6.311# (OPT.2), C5.102#**	Minimize erosion and sedimentation from construction activities.	Plan of operation for road construction to include schedule of proposed progress description of erosion control work and approval of deviation from plan.	No Reference

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
SITE PREPARATION	PRESCRIBED FIRE	**Use soil management guidelines for site productivity protection and water quality maintenance.**	To maintain the protective capacity of the forest floor while meeting silvicultural objectives.	Maintenance of soil organic matter and dead and down woody debris is necessary to maintain long term site productivity.	56,58
SITE PREPARATION	MACHINE PILING/ CRUSHING	**Use prescribed piling techniques to reduce detrimental soil compaction and erosion. C6.4(OPT.1,2 &3)**	To maintain soil productivity by minimizing soil compaction and erosion.	Site disturbance from machine piling can result in soil compaction and erosion. Minimizing areas detrimentally impacted is necessary in order to maintain long term site productivity.	59

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MANAGEMENT ACTIVITY	SUB-ACTIVITY	RECOMMENDED MANAGEMENT PRACTICE	GOAL	EXPLANATION	DOCUMENT LOCATION
WATERSHED RESTORATION	SUBSOILING ROADS & TRAILS	**Use winged subsoilers for all soil rehabilitation projects involving amelioration of compaction. C6.4(OPT.3)**	To maintain site productivity by restoring soil properties to pre-impact conditions.	The use of winged subsoilers has proven to be effective in restoring compacted soils to near pre-impact soil conditions.	No Reference
WATERSHED RESTORATION	All	**Develop watershed restoration inventory.**	To improve water quality and soil stability by developing a watershed restoration needs inventory; by identifying cost effective projects to be funded through (KV) and/or other funds.	Watershed restoration inventories or needs should be accomplished on a project by project basis. This project list should lead to the development of a District wide inventory. The District inventory will be used to develop cost effective restoration plans and to develop a District priority list.	60
WATERSHED RESTORATION	KV PROJECTS	**Watershed Improvements, enhancements or mitigation.**	Restore watershed productivity.	See appendix for list of appropriate KV projects.	60

SALE DESIGN

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Also see chapter on Logging Management Practices Exclusive to Streamside Management Units.

A. TIMBER HARVEST UNIT DESIGN

1. **Management Practice** --
 -- Evaluate cutting units to estimate the response of watersheds to the proposed sales. This analysis usually includes:
    -- vegetative recovery status of past harvests
    -- allowable area that can be clearcut
    -- condition of channels
    -- number, size, silvicultural prescription and location of harvest units
    -- erosion hazard rating (EHR) for individual units
    -- estimated location and size of roads and skid trails
    -- logging system design
    -- potential natural recovery rate of the watershed.

2. **Management Practice** --
 -- Where adverse water or soil quality impacts and undesirable streamflow can result, the harvest unit design should be modified, and/or the natural recovery rate can be accelerated using watershed treatment measures.

Objective -- Insure that unit design will secure favorable conditions of water flow and water quality. More specific objectives are found under individual management practice sections.

Administration -- The above analysis is the responsibility of the ID Team. The team may recruit the services of the watershed specialists or District watershed representative. The specifics for accomplishing the analysis are described in various management practice sections throughout this document.

B. USE OF EROSION HAZARD RATINGS

Management Practice -- The R-5 Erosion Hazard Rating (EHR) system should be used to estimate the potential erosion hazard of a given area. The EHR evaluates the soil-topography-climate-cover relationships of site specific areas. Where the EHR is "moderate" most timber management activities can be done without special constraints. Where the EHR is "high", the use of soil disturbing equipment should be minimized, harvesting method modified, or specific mitigation measures should be prescribed that will maintain the watershed stability. Where the EHR is very high, soil disturbing activities should be avoided. (A copy of the EHR form is included in Appendix H.)

Objective -- Identify erosion hazard areas to avoid excessive land disturbance and associated water quality degradation.

Administration is through contract provisions B6.6, B6.65, and B6.66. The analysis will be the responsibility of the watershed specialists or the District watershed representative. EHR information will be available in the soil data base.

C. USE OF TIMBER SALE MAPS FOR DESIGNATING WATER QUALITY PROTECTION NEEDS.

Management Practice -- Designate the following features on the sale area map where applicable:

1. Location and classification of stream courses to be protected.
2. Wetlands, meadows, lakes, potholes, springs, etc.
3. Specified roads.
4. Roads where log hauling is prohibited or restricted.
5. Areas where different skidding or yarding methods are required.
6. Water sources available for contractor's use.
7. Other features required by Division "C" contract provisions.
8. Boundaries of harvest units.
9. Fireline location.

Objective -- Identify protection areas and water sources for Purchaser and TSA.

Administration is through contract provision B1.1.

D. PROTECTION OF UNSTABLE AREAS

Management Practice -- Defer harvesting on unstable areas if the ID Team determines that current or prospective logging methods even with mitigation would result in unacceptable watershed damage.

Objective -- Provide special treatment of unstable areas to avoid triggering mass failures.

Administration is through decisions made during design of sale. If an area is determined at project level to be unsuited for timber harvesting due to instability, ID team needs to make sure this information is stored in the TRI database. Land use planning will later utilize information for Forest Plan updates.

E. PEAK STREAMFLOW ANALYSIS

Management Practice -- When identified as an issue or concern, a peak streamflow analysis will be completed to insure that peakflow changes caused by timber removal will not be detrimental to the hydrologic functioning of the stream channel. This analysis is based in part upon the capability of specific stream-courses to resist peakflow damage. In some cases a watershed representative, hydrologist, or fishery biologist will also take part. When the peakflow analysis shows that an alternative will not meet the peakflow change standards, then either (1) redesign alternative's cutting unit layout or (2) provide for the performance of the more accurate WET hydrologic computer program. Safe peakflow decreases should be prescribed for poor stability streams. See Appendix B., Peak Streamflow Analysis for detailed procedures and explanation of "safe peakflows".

Objective -- Peak streamflow increases resulting from management activities should be limited to what the channel can safely handle. Peakflow should not be decreased to the extent that flows are insufficient to keep sediments moving downstream. Safe peakflow decreases should be prescribed for poor stability streams.

Administration is through ID team evaluation of proposed EA alternatives.

F. LIMITING THE OPERATING PERIOD OF TIMBER SALE ACTIVITIES

Management Practice -- Limiting the operating period is identified and recommended by ID Team.

Objective -- This "C" provision should be used to limit the purchaser's operations to specified periods of the year.

Administration -- The purchaser's operation may be conducted outside the "normal operating season" when the requirements of of B6.65 are met. This limitation should be used to avoid operations during wet weather season or high water season when conditions of B6.6 and B6.65 are not being met.

G. DETERMINING THE SUITABILITY OF GROUND-BASED HARVEST SYSTEMS

Management Practice -- The Erosion Hazard Ratings (EHR's) are to be used to assist in determining acceptable yarding systems and silvicultural prescriptions. Ground-based systems are permitted on slopes of 30% or less or where the EHR is 8 or less. With specified mitigation and abatement prescriptions, and with tight administrative control, ground-based logging may be allowed when the EHR exceeds 8. Ground-based logging on slopes over 30% should be minimized both from a safety and resource management aspect. Adverse skidding on slopes greater than 10% generally will not be acceptable from a soil displacement, machine capability, and safety stand point. Other systems should be used in these situations.

Objective -- The EHR's assist in determining the acceptable intensity of and restrictions for land disturbance activities.

H. GROUND SKIDDING DESIGN - FALLING TO LEAD AND END LINING

1. **Management Practice** -- The careful control of skidding equipment serves to avoid on-site and downstream channel damage, buildup of destructive runoff and erosion in sensitive watershed areas such as meadows and streamside management units (SMU's).

Two complimentary methods of protecting soil productivity and water quality by ground-based skid trail design are:

1. End lining -- This involves winching logs directly out of falling areas by cable. Skidding equipment must stay on skid roads.

2. Felling to the lead -- This involves felling trees toward a predetermined skid pattern. This procedure facilitates skidding operations and minimizes soil compaction, displacement, and stand damage.

2. **Management Practice** -- Skid Trail Widths

On stands with high conversion value, skid trails should be spaced approximately 100-150 feet apart; the trails should average no more than 12 feet in width and skidding equipment should be required to stay on the trails. At this spacing trails may be considered a permanent part of the transportation system. As such, they should be located so they provide efficient access for future entries. Subsoiling of skid trails may not be required but would be dependent on silvicultural objectives and time period between entries (with 5 years or less between harvest entries you may not want to require subsoiling if skid trails are located properly to facilitate skidding operations).

On stands with a low conversion value (stands requiring highly mechanized equipment), skid trail spacing may range from 60-75 feet depending on the type of equipment being used. Trails should be no more than 12 feet in width. Skid trail spacing of 60-75 feet is possible in clearcut stands where double bunching and/or boom shears are used. Use of boom shears reduces the amount of ground covered by the harvest and skidding equipment. At 60-75 foot spacing, skid trails will occupy more than 20% of a harvest unit when landings and existing transportation system is included. Compaction on these trails should be mitigated by subsoiling with a winged subsoiler.

One other consideration in spacing skid trails is that spacing may be dependent on the need for the protection of the residual stand. In these cases the need for protection must be weighed against the probability of soil compaction with closer trail spacing. The 100-150' spacing is especially critical when HFR is prescribed if protection of the regen is to occur.

3. **Management Practice -- Restriction of off-trail skidding under saturated soil conditions.**

Under saturated soil conditions no off-trail skidding or machine falling should be allowed. Skidding on designated trails may be allowed as long as such use does not cause deep rutting causing erosion damage, or an erosion damage potential (B6.6). Allowing skidding under these conditions makes mitigation by subsoiling less effective and should be avoided both on and off trails.

4. **Management Practice -- Off-trail skidding under non-saturated soil conditions**

If necessary, off-trail skidding may be allowed when soil moisture is below field capacity and when litter, slash or other vegetation is dense enough to support harvest equipment and when silvicultural objectives can be met. A minimum of 10" of litter and slash is required. Only a limited number of passes should be allowed and only under the above conditions such that supporting conditions do not decrease. The lowest ground pressure piece of equipment available or equipment with a swing grapple or boom shear should be utilized. All off-trail skidding should be limited in extent regardless of conditions.

At field capacity the soil feels wet and leaves moisture on your hands. On volcanic ash soils, moisture will be on the surface of a ball when shaken in the hands.

5. **Management Practice -- Logging over 2 feet or more of snow or ground frozen to a depth of 4 inches or more** is an acceptable alternative to requiring use of designated skid trails. Skidding over frozen ground is the preferred method of operation.

Objectives -- Minimize ground disturbance, especially soil compaction, displacement and puddling.

Administration -- C6.46 (Opt.1), C6.46 (Opt2)

6. **Management Practice -- Special erosion protection measures** may be required in areas where soil stabilization problems are not expected to be taken care of with the timber sale contract.

Objectives -- To provide appropriate erosion control and sedimentation protection on disturbed lands.

Administration -- C6.4, B6.5, C6.51, B6.65

I. LOG YARDING SUSPENSION REQUIREMENTS

Management Practice -- Full or partial suspension log yarding should be required when the Erosion Hazard Rating is 8 or higher.

Objective -- The objective of this recommendation is to minimize ground disturbance on land with high erosion potentials.

Administration -- B6.5, B6.65, C6.3 (Opt.1), C6.3 (opt. 2), C6.42#, C6.43

WATERSHED MANAGEMENT PRACTICES EXCLUSIVE TO STREAMSIDE MANAGEMENT UNITS

WATERSHED MANAGEMENT PRACTICES EXCLUSIVE TO STREAMSIDE MANAGEMENT UNITS

A. STREAMSIDE MANAGEMENT UNIT (SMU) WIDTH

Definition -- The SMU is the zone adjacent to streamcourses where special precautions (management practices) are specified for preventing detrimental streamcourse sedimentation and riparian management zone soil damage. The primary vehicle for achieving this is tighter restrictions on bare soil production -- bare soil which if too great can erode and become sediments in stream channels. This action to reduce bare soil also provides for maintenance of the integrity of the included riparian management zone. The width of the SMU is 150 to 200 feet wide next to Class I thru IV streamcourses, whereas the width of the riparian management zone is 60 to 100 feet wide and is normally not specified next to Class IV streamcourses. (See this chapter's G. 1. for additional definitions of riparian terminology.)

Management Practice -- Set the width of the SMU on either side of Class I, II, III, and IV streamcourses at 150 feet slope distance for sideslopes 30 percent or less, and 200 feet for slopes greater than 30 percent.

Objective was identified under definition above.

Administration of specific practices for SMU's will be discussed later -- many of the following management practices refer to SMU's as part of their specifications. SMU boundaries may have to be put on sale area map in order to administer some of the practices.

B. "STREAMCOURSE" DESIGNATION

Management Practice -- "Streamcourse" as used in a timber sale contract means all Class I, II, III and IV streams. All of these streamcourses must be designated on the contract sale area map.

Objective -- Provide a tool for sale contract administrator for communicating with Purchaser regarding contract provisions and associated Management Practices.

Administration requirements of B6.5 and other contract provisions that utilize "streamcourse" in their wording are applied with reference to the sale area map. Watershed management specialist will generally supply the mapping of I, II and III streams. Sale layout people should be instructed to provide the Class IV information for individual subdivisions. The TRI aquatic subsystem can be utilized also, but there often are errors associated with the III and IV designations. (This subsystem should be updated with the new mapping data.) See Appendix C. for stream classification instructions.

C. FELLING OR PULLING TREES ACROSS STREAMCOURSES

1. **Management Practice** -- On Class I and II streams, trees should be felled away from the streamcourse. No cable-pulled logs should be allowed to touch streambanks or channel bottom. The only trees that will be pulled out of channel are those that accidentally fall in, such as when a gust of wind defeats logger's intentions.

   Objective -- Prevent any disruption of the stream channel, most of which would occur upon dragging trees out of or across the channel (not felling), and to prevent the accumulation of slash that would later have to be removed by hand.

   Administration may be by contract provision C6.51 or C6.41.

2. **Management Practice** -- On Class III streams where full suspension yarding is not being used, trees should be felled so that they don't fall over the streamcourse, except those that would be difficult or unsafe to fell any other way. (Only these trees and accidental ones should be dragged out of the streamcourse.) Partial suspension yarding from adjacent areas is allowed if dragging trees across the streamcourse will cause 5 percent or less streambank or bottom disturbance, averaged over the length of stream within the subdivision.

   Objective -- Only allow felling or cable-pulling across streamcourse where this will cause 5 percent or less streambank or bottom disturbance, averaged over the length of stream within the subdivision.

   Administration --

   -- This requirement can be administered by contract provision C6.3# (Option 1) with the above management practice being the Special Sale Objective and the following being the Measuring Compliance statement: If no more than an average of one tree per 100 feet of streamcourse included within the subdivision is felled across the stream, then the Sale Objective will have been met. (The number of trees per 100 feet can be changed by sale designers if they have better data relating to achieving the objective.)

   -- The C6.3 Measuring Compliance statement is the working tool (contract provision) that definitively describes what this means for the Purchaser. It is the job of the sale designer and/or layout people to decide what logging systems situations will allow for meeting the Measuring Compliance statement or whether another specified number of trees per 100 feet can be given to meet the 5 percent objective.

   -- Other contract provision options are B6.5, B6.6 relying on the "minimize soil erosion" phrase, and C6.51 or C6.41 if the easiest tact is wanted.

3. **Management Practice** -- On Class IV streams, treat as in 2. except when streamcourses have been designated that can be safely felled or cable skidded across.

Objective -- Only allow felling or cable-pulling across streamcourses where this will cause 10 percent or less streambank or bottom disturbance, averaged over the length of stream within the subdivision.

Administration will be as in 2. when necessary. Situations besides full suspension likely to allow for felling over IV streams are (a) when the stream does not have more than six inches of vertical streambank--rocky channel side bars gently gradate into the vegetated streambank edge, or (b) when trees are subsequently to be yarded by one-end suspension cable systems. Sale layout people can identify the channel criteria and report safe situations to sale designers for correction of the sale area map.

D. STREAMCOURSE WOODY DEBRIS

1. **Management Practice** -- For Class I and II streams, any logging debris that gets into a streamcourse should be removed within 48 hours.

   Objective -- Prevent streamflow from being deflected by debris against channel surfaces which causes excessive erosion. Also we don't want the debris to be picked up and floated to places where it might dam-up and later fail, releasing torrents of water that cause abnormal channel cutting. Generally as a result of meeting C. 1. above, little slash gets into stream channel.

   Administration is through contract provision B6.5.

2. **Management Practice** -- For Class III and IV streams, logging debris should be removed within 15 days of its occurrence within the channel.

   Objective -- Same as 1. above with allowance for a little more risk for III and IV streams.

   Administration is through contract provision B6.5 with a Purchaser agreement as to 15 days rather than 48 hours. If District sale administrator feels that this agreement will be unworkable, then revert back to the 48 hour B6.5 criteria. (There is no longer a situation where contract provision C6.5 is applicable.)

3. **Management Practice** -- Down trees that influence or will eventually influence stream channel dynamics should not be removed. Within all streamcourses, leave down trees that existed before sale which are partially incorporated into the channel or laying across any portion of the channel. Do not remove the ends of these logs that are resting upon the streambank top. If there has been a catastrophe such as a blow-down or flood, contact should be made with watershed representative, hydrologist or fish biologist.

   Objective -- Maintain the natural stream dynamics which have been developed, at least partially, in response to natural accumulations of embedded logs. This natural debris produces pools, provides aquatic animal habitat, catches some sediment, and reduces, on the whole, disruptive channel cutting. Provide a supply of down logs to later be incorporated into the channel bottom.

   Administration is through contract provision C6.52 for logs embedded into the channel sediments. This provision is needed because in some subdivision situations the embedded trees are defined as "included timber". For trees not embedded, leave-tree marking will have to be employed.

E. FUTURE REPLACEMENT LOGS FOR CHANNEL

Management Practice -- On Class I, II, III and some IV streams, standing old trees should be left for the purpose of eventually blowing down and replacing down trees presently in the channel that are acting to maintain stream dynamics and fish habitat. These trees should be within 20 feet of streambank and already leaning toward stream, or if not leaning toward stream, be left on alternating sides. The type of trees to leave should be the largest diameter trees which (if green) are also good seed producers -- they will be also helping to regenerate the stand. The number of trees left should be two per 100 feet of stream channel length if the trees are leaners and four per 100 feet if not (one leaner equals two non-leaners). This can be further adjusted according to general wind flow, sideslope steepness, local beaver habits and expected wood-cutter pressure. Watershed specialist or ID team may specify other numbers -- this will only occur if more exact data was obtained during a field inventory. Trees should be left adjacent to IV streams if present bank stability is poor -- less than 60 percent stable banks.

Objective -- Same as for Management Practice D. 3. above. Additional reasons for leaving the trees are (1) for insect habitat (in decadent trees) and food for birds needed to combat insect epidemics outside riparian areas, and (2) for logs to be cut for fish habitat enhancement structures.

Administration is through adaptation of the Practice into cutting unit tree marking guides. Sale layout people can identify the channel criteria and report stability condition to sale designers for incorporation into the sale plan and sale area map.

F. GROUND-BASED SKIDDING ACROSS STREAMCOURSES

1. **Management Practice** -- Crossing of streamcourses by skidtrails should utilize the following techniques:
   - -- Class I streams: No crossing.
   - -- Class II: Temporary bridges--structure only touches top of streambank.
   - -- Class III: Temporary culverts or log corduroy may also be used. Log corduroy must extend up on and past streambank edge far enough to prevent soil gouging that drags the soil over and into the stream channel.
   - -- Class IV: Fords may also be used but only if crossing area has vertical banks that are six inches or less tall and has channel rock that is predominantly six inches or greater in diameter. Log corduroy bank protection as described above should be used before significant soil amounts are dragged into the stream.

   Objective -- Prevent all skidtrail production of sediments in Class I and II streamcourses and less than three cubic feet at each III and IV stream crossing.

   Administration can be provided by Forest Service designation/approval of skidtrail location thru use of B6.422 and B6.5. C6.5. can also be used. In terms of 2400-6 contract, the path used for all non-full suspension yarding of trees across streamcourses should be classified as a Temporary Road (B6.5, (b))

2. **Management Practice** -- Skidtrails across Class III and IV streams should average no more than one per 500 feet of channel length; across ephemeral draws they should average no more than one per 200 feet of channel length. (There is no restriction on II's because of their use of insignificant sediment producing bridges.)

   Objective -- Skidding activities should produce no more than three cubic feet of sediment per 500 feet of III or IV channel, and per 200 feet of ephemeral channel.

   Administration is through B6.422 and/or C6.4 which require agreement on skidtrail location.

3. **Management Practice** -- Skidtrails should not occur within six feet of the low point of ephemeral draws. (Crossings are allowed though.)

   Objective -- Prevent the start of an eroding head-cutting channel and maintain good growing conditions in these higher productivity microsites.

   Administration is through contract provision B6.422 and/or C6.4 which require agreement on skidtrail location.

4. **Management Practice** -- Temporary culverts and log corduroy should be removed as soon as skidding use of each crossing is finished.

   Objective -- Reduce risk of rainfall-caused high streamflow washing out structures with resultant release or erosion of soil into the streamcourse.

   Administration -- Contract provision C6.6.

G. RIPARIAN MANAGEMENT ZONE AND STREAM TEMPERATURE

1. Definition --

-- Streamside Management Unit (SMU) -- See A. in this chapter for definition.

-- Riparian Area --

Is composed of the aquatic and riparian ecosystems. The aquatic ecosystem is the area within the stream channel. The riparian ecosystem is the ground area identified by distinctive vegetation communities and soil characteristics that require free or unbound water. (Forest Practice Rules for Eastern Oregon leaves out aquatic area.) (After this definition section, the riparian area term is probably not used again -- most management practices are directed instead towards the term below.)

-- Riparian Management Zone --

Is composed of the riparian area and an adjacent dryland area. The dryland area provides close-by dry habitat needed by some wildlife that utilize the wetter areas; it also acts to lessen microclimate warming in the moister areas caused by opening adjacent upslope tree stands. It is not just a strip that shades stream water since wide tree stand strips are also prescribed on the north side of streams. (Forest Practice Rules for Eastern Oregon uses the term Riparian Management Area.)

A riparian management zone exists, at least, adjacent to all Class I, II and III streamcourses (generally perennial streams). (A wildlife specialist may specify additional seep, wet meadow, etc. riparian management zones away from streams that also need the application of this section G. Management Practices).

It is difficult and time consuming to use herbaceous and brush vegetation types and soil characteristics to determine the riparian management zone edge. Therefore, unless you have better information, use the following management practice.

2. **Management Practice** -- Unless you have better information, use the following guide for designating the outside edge of the riparian management zone:

-- Class I or II streamcourses -- 100 feet of slope distance on either side of streambank.

-- Class III streamcourse -- Place edge where floodplain (flatter area) hits the sidehill toeslope, but constrained by no less than 60 feet and no more than 100 feet.

3. **Management Practice** -- For Class I, II and III streams:

-- Within riparian management zones, timber harvest will generally be by either small group selection or individual tree selection techniques. In situations such as when a stand is dead or soon to be dead, when even-aged silviculture will better meet riparian area objectives, its application is acceptable but hydrologist input should be requested.

-- This table gives additional criteria:

Stream class	Maximum opening width 1/ (tree length)	Tree crown cover 2/ (% of potential)
I	1	95
II	1.5	90
III	2	80

1/ At least 90% of openings produced by small group cutting should be no wider than these values. Non-clearcut widths between these cleared ones should be at least this wide. Width is assessed along a line parallel to stream. Tree length is the typical height of the trees to be removed. Openings can face each other on either side of the stream.

2/ Assume potential crown cover is 100% unless better data exists. The unit for assessment is the length of streamcourse between perennial (class I, II or III) stream forks, or up to where perennial stream changes to an intermittent (class IV) channel. The crown cover standard is thus a weighted average -- individual acres can have less than the standard value.

-- If project planners would rather utilize basal area data as an index to proper shading of stream, then the procedure in Section A. in the Appendix can be used. Basal area data probably will already exist for stands of interest and thus this second option may be more expedient in some situations.

For Practice 2. and 3.:

Objective -- Achieve Oregon water temperature standards on Class I and II streams as well as provide for diversity in riparian wildlife habitat and species along all perennial streams.

Administration is through map designation of cutting unit location (in EA alternative development) and tree marking (layout).

4. **Management Practice** -- Within subdivisions within riparian management zones, at least 90 percent of brush within 10 feet of streambanks should not be damaged by felling or skidding. At least 75 percent of brush greater than 5 feet tall should not be damaged within the rest of the riparian management zone. (Also see this chapter's E., Future Replacement Logs for Channel, and D. 3., Streamcourse Woody Debris.)

   Objective -- Provide for riparian wildlife habitat and species diversity and as high a density as possible for bank protecting, brush roots.

   Administration can be by contract provision C6.3# (Option 1) with the Practice being the Special Sale Objective. It may also be administered by contract provision B6.3 using "conduct [operations] in a workmanlike manner".

H. **SMU BARE SOIL** (Below, either option 1. or 2. may be used.)

1. **Management Practice** -- When bare soil can result from ground-based yarding, subdivisions within SMU's should have no more than an average of one tractor skidtrail per 150 feet of streamcourse, assessed along a line parallel to the channel. Skidding equipment must be kept on the designated skidtrail. No landings should be within 100 feet of the streamcourse.

   Objective -- Prevent sedimentation of streamcourses by limiting bare soil and soil erosion within SMU's to acceptable levels. The bare soil indexes of acceptable levels are shown in Practice 2. below.

   Administration is thru contract provision B6.422 and/or C6.4 which require agreement on skidtrail and landing location.

2. **Management Practice** -- Within SMU's, trees within 100 feet of streamcourses should be removed by cable yarding or tractor mounted winch. Landings should not be within 100 feet of streamcourse. In the area from 100 feet out to the outer edge of the SMU, the combined effect of both logging (excluding truck roads) and subsequent activities should result in no more bare soil than the values displayed below:

Sideslope gradient (%)	0-4	5-24	25-44	45-64	65+
Bare soil (%)	20	15	10	7	5

   Notes --

   -- If SMU has existing, naturally-occurring bare soil, add these values to it. For example: If sale layout people see significant (5% or greater) naturally-occurring bare soil within SMU's, they should perform a "before logging" transect (described below). For example if they measured 15% bare soil, this 15 value would be added to the table constraint values to get the adjusted objective.

   -- The unit within which to determine bare soil is each 50 pace (2-step) interval along lines parallel with the streamcourse. Each "hit" of the right foot on bare soil thus equals 2% bare out of the total of 50 hits possible.

   Objective -- Prevent sedimentation of streamcourses by limiting bare soil and soil erosion within SMU's to acceptable levels. The bare soil indexes of acceptable levels as specified in the table should not be exceeded.

   Administration can be thru contract provision C6.3# (Option 1). It may also be administered by B6.6 using its "minimize erosion" phrase as well as B6.422.

I. SITE PREPARATION AND PRESCRIBED FIRE WITHIN SMU'S

Management Practice -- This chapter's Management Practices G. 4. and H. 2. should be adhered to after making the following changes:

-- For G. 4. (applied just within riparian management zone portion of the SMU), all snags, and down logs 10 inches diameter or larger should also be protected from fire.

-- For H. 2., when dealing with prescribed fire (not mechanical site prep) the bare soil specifications should be applied just for the riparian management zone, or if a non-riparian IV stream, 100 feet away from channel. There are no SMU specific criteria for area farther away than 100 feet -- for this area follow the guidelines shown in the chapter on Site Preparation and Watershed Restoration.

Objective -- Maintain healthy riparian zone and water quality by minimizing bare soil and erosion levels within SMU's.

Administration -- Because of the difficulties involved with maintaining the bare soil constraints on steeper ground, site preparation and prescribed fire may have to be eliminated as a management tool there. SMU boundaries on steep ground often will have to be firelined. Logging slash may be reduced by other methods such as "leave top attached" or whole tree yarding out of riparian area. Generally bare soil site prep is not very important within the moister growing condition SMU -- many new trees become established without fire or bare soil. On gentler ground (15 to 20 percent bare soil permissible) prescribed fire techniques such as letting fire back-down into riparian area will usually achieve maximum bare soil and "brush leave" objectives -- firelines may have to be built tho to protect 10 inch plus down logs and snags that are left to meet this chapter's Management Practice E.

J. SMU WATERBARRING

Management Practice -- For SMU's, waterbars on skidtrails, tractor roads and firelines should always be used on gradients of 5% or greater. They should be spaced according to the following table. They should be used in addition to any other treatment used such as ripping. Last waterbar should be about 15 feet from channel.

	Typical Spacing (Feet) for Soil Erosion Class		
Gradient(%)	High	Moderate	Low
3-19	80	110	160
20-39	40	60	80
40 plus	25	35	50

Soil erosion classes may be calculated with the procedure given in Erosion Hazard Calculation, Appendix H. If preferred, the erosion class may be obtained from the following guide that lists rock types according to erosion class:

High -- granite, sandstone, andesite porphory, glacial or alluvial deposits, soft matrix conglomerate, volcanic ash, pyroclastics

Moderate -- basalt, andesite, quartzite, hard matrix conglomerate, rhyolite

Low -- metasediments, metavolcanics, hard shale

Objective -- Provide water bar spacing necessary to prevent formation of erosion channels that are deeper than one inch.

Administration is through contract provision B6.64 with stipulation that within SMU's, backblading cannot replace waterbars. (Don't make agreement with Purchaser that B6.64 says is possible.)

K. SMU EROSION CONTROL TIMELINESS

1. **Management Practice** -- Within SMU's, erosion control work that includes surface drainage (as identified by contract provisions B6.6 through B6.65), on skidtrails, landings and temporary roads should be completed within 15 calendar days after yarding operations related to each landing are substantially completed. After September 15, and as long thereafter as operations continue, the work should be done as promptly as practicable.

   Objective -- This is required (by contract provision C6.6 instructions) on all subdivisions that have erosion control seeding and therefore, it will normally be used. For those SMU subdivisions without seeding, it should be used anyway for meeting the objective of cost-effectively and substantially reducing the risk of eroded soil reaching stream channels.

   Administration is through contract clause C6.6.

2. **Management Practice** -- When a subdivision falls within a sensitive area and when there will be a significant risk of eroded soil reaching the streamcourse, then a time period must be specified that identifies the unsafe period. Within the unsafe period, sale operations should be discontinued and erosion control measures should be in place and effective (vegetative [seeding] measures should have been finished, but of course, will not yet be effective). Sale operation discontinuance includes specified and temporary road construction but does not include specified road use.

   Definitions/Criteria:

   -- Sensitive Area -- The SMU surrounding Class I or II streams, or Class III streams within 1000 feet of I or II's, or Class IV streams within 1000 feet of I or II's if they will be flowing during sale operations within the SMU.

   -- Significant Risk:
      -- If Temporary Road use or construction will occur within the SMU, then apply the operation restriction.

      -- If specified road construction or reconstruction will occur within the SMU, and this has a potential for contributing a total of 8 cubic feet or more of soil to any individual 1000 feet of streamcourse, then apply the operation restriction. This 8 cubic feet is the cumulative amount that could occur before road is Substantially Completed. Thus it also includes soil that may wash off of road during rainstorms. Because of difficulties in estimating the above, it will often be better to just go ahead and call for the operation restriction.

      -- If neither of the above:
         -- If included riparian management zone (see this chapter's Management Practice F. 1. for definition) will not be logged and will have less than 5% cable skid trails leading thru it, then there is not any significant risk and operations do not have to be restricted.

         -- If riparian management zone will be logged or have 5% or more logging caused bare soil:
            -- If is a Class I or II stream and sideslopes are greater than 10%, then apply the operation restriction.

            -- If is a Class III or IV sidestream and sideslopes are greater than 25%, then apply the operation restriction.

   -- Time Period (The unsafe period):
      -- If a non-anadromous fish stream, then the period is September 15 thru the end of spring rains (June 15 usually) or the end of on-site snowmelt if later than June 15.

      -- If an anadromous fish stream, then the period is at least the above but is further extended to include the time when young fish are still within the stream gravels.

Objective -- Comply with contract provision C6.315 and C5.232.

Administration --

-- Administration is through contract provision C6.315, C6.311, or if just dealing with a specified road within the SMU, C5.232. C5.1 (Option 1) may also be used if it is easier to just prohibit all Temporary Roads in Sensitive Areas. Sensitive area subdivisions must be shown on the sale area map; often therefore an otherwise whole subdivision has to be broken in two. When sale operations are taking place, provision C6.6, 15-day criteria is still in effect.

-- Some closed roads require replacement of stream crossing structures upon opening -- ordinarily provision C5.4 would be used. If the crossings are in sensitive areas and more than 8 cubic feet will be produced, then the roads should be reclassified as needing "reconstruction" in order to be able to comply with this timing requirement.

-- Fish biologist or hydrologist can, upon request, supply the unsafe/safe time period for anadromous fish.

SALE ADMINISTRATION

SALE ADMINISTRATION

A. DESIGNATING LOG LANDING LOCATIONS

Management Practice -- Location of all landings and landing clearing limits shall be agreed to by the USFS and Purchaser prior to construction. The following criteria should be used in evaluating landings:

1. The cleared or excavated size of landings shall not exceed that needed for safe and efficient skidding and loading operations.

2. Where a choice exists, landing locations should be selected which involve the least amount of excavation and the least erosion potential.

3. Locate landings where the least number of skid roads are required and sidecast will neither enter drainages nor damage other sensitive areas.

4. Landings should be positioned so that the skid road approach can most often be nearly level.

5. Avoid landing locations alongside or in meadows, dry and wet draws, and drainages and other areas that cannot be drained or where excessive cuts and fills are necessary.

6. On constructed landings restore the shape of the landings back to the natural configuration or shape to lead the runoff to preselected spots where water can be dispersed to natural, well-vegetated, gentle ground.

B. ADMINISTRATION WITHIN SMU'S

Refer to chapter on Watershed Management Practices Exclusive to Streamside Management Units.

C. TIMELY EROSION PREVENTION AND CONTROL

Management Practice -- Equipment shall not be operated when conditions are such that soil and/or water damage will result. Contract provision B6.6 and B6.65 must be met. The kinds and intensity of erosion control work done by the purchaser shall be adjusted by the ground and weather conditions and the need for controlling runoff. Erosion control work shall be kept current. The feasibility of allowing harvest operations should be weighed against the operators ability to effectively mitigate existing or potential erosion problem areas (i.e. rutted roads during winter operations are not easily or effectively waterbarred). (See chapter on Watershed Management Practices Exclusive to Streamside Management Units, Section K. of this report for additional information).

Administration -- Refer to B6.6, B6.65 and C6.6 for contract provisions.

D. EROSION CONTROL ON SKID TRAILS AND FIRELINES

Management Practice -- Revegetation measures, including grass seeding must be supplemental to other stabilization measures such as mulching, pitting, scarifying, subsoiling, waterbars and dips.

Management Practice -- Waterbars on skidtrails, tractor roads and firelines should be used on gradients of 3% or greater. They should be spaced according to the following table. Where subsoiling is employed, waterbars may not be necessary. Subsoiling off skid trails or periodically not subsoiling may substitute for waterbars. Last waterbar should be about 15 feet from any streamcourse that may exist.

Typical Spacing (Feet) by Soil Erosion Class

Gradient(%)	High	Moderate	Low
3-19	80	110	160
20-39	40	60	80
40 plus	25	35	50

Soil erosion classes may be calculated with the procedure given in Erosion Hazard Calculation, Appendix H. If preferred, the erosion class may be obtained from the following guide that lists rock types according to erosion class:

High -- granite, sandstone, andesite porphory, glacial or alluvial deposits, soft matrix conglomerate, volcanic ash, pyroclastics

Moderate -- basalt, andesite, quartzite, hard matrix conglomerate, rhyolite

Low -- metasediments, metavolcanics, hard shale

Administration -- Contract provisions B6.5, B6.65, B6.64.

E. ACCEPTANCE OF EROSION CONTROL MEASURES BEFORE SALE CLOSURE

Management Practice -- Acceptable erosion control means only minor deviation from established standards, provided no major or lasting damage is caused to soil or water. TSA's will not accept as complete erosion control, measures which fail to meet these criteria.

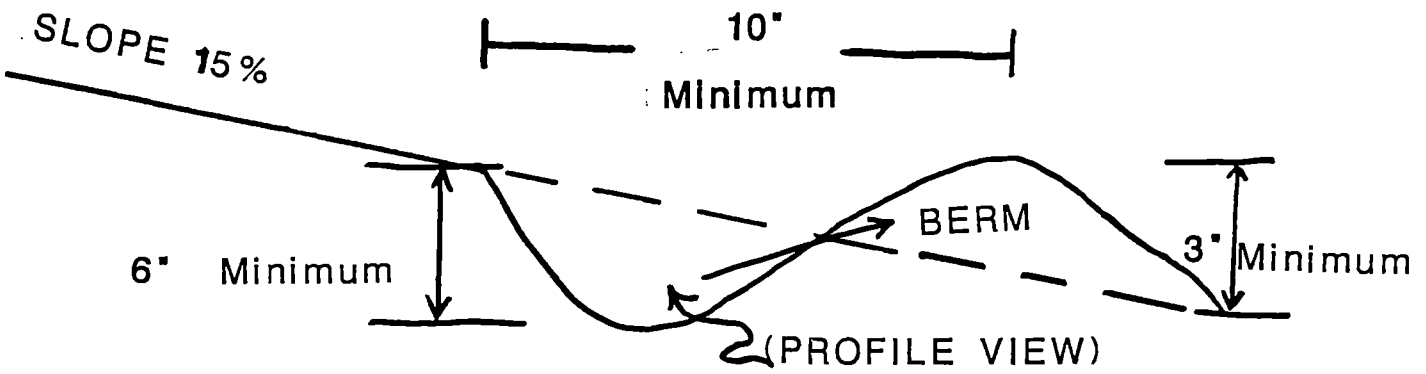
The figure on the next page represents design criteria for hand constructed waterbars. On system roads or trails where use is anticipated machine constructed waterbars will be more effective over time.

Hand Constructed Firelines: On hand constructed firelines, waterbars should be constructed when slopes exceed 15% and should meet the following design criteria:

Minimum excavation depth: 6 inches
Minimum berm height : 4 inches
Minimum waterbar width : 8 inches

Administration -- Contract provision B6.6.

WATERBAR CONSTRUCTION DIAGRAM



HAND WATERBAR CONSTRUCTION RECOMMENDATIONS
FOR FIRELINES, CLOSED ROADS AND SKIDTRAILS

Waterbars should be excavated into the roadbed, fireline or skidtrail a **minimum of 6 inches deep on the upslope section and 8 inches deep** at the outlet or road shoulder with a definite adverse grade onthe downgrade side of the cross-drain.

Excavated material should be spread on the roadbed below the cross-drain to a minimum depth of 4 inches.

Extend the cross-drain the full width of the road so that water flows downhill from the toe of the cutbank (or uphill section) to the road shoulder (outlet).

The long axis of the cross-drain should form an angel of 45 degrees but not less than 30 degrees with a line across the road, fireline, or skidtrail, perpendicular to the centerline.

	WATERBAR INTERVAL BY SOIL EROSION CLASS		
SLOPE	LOW	MODERATE	HIGH
3-19%	160'	110'	80'
20-39%	80'	60'	40'
40%+	50'	35'	25'

IMPORTANT POINTS: The downslope end of the waterbar must be open to allow free passage of water.

The watebar should be constructed so that it will not deposit water where it will cause erosion.

In areas where vehicular traffic can be anticipated more substantial waterbars will be required. The minimum depth requirements will be 8 inches on the upslope portion and 12 inches on the outlet section of waterbar.

F. TIMING OF SEEDING

Management Practice -- The normal seeding season is from July 15 to November 15. The intent is to seed when there is a high likelihood of seed germination and establishment. Seeding late in the spring generally results in plant burnout. Ideal time for seeding is early to late fall to take advantage of fall rains. Do not seed between May 15 and July 15. To improve the probability of vegetation establishment do not seed when snow depth exceeds 6 inches.

Upon satisfying the above, seed immediately after (within 15 days) ground-disturbing activity to take advantage of a favorable seedbed.

G. MAINTENANCE AND FOLLOW-UP INSPECTIONS OF EROSION CONTROL WORK

1. **Management Practice** -- Periodic inspections should be made of all logged areas to determine the effectiveness of soil erosion and stabilization measures and to determine if additional precautionary measures are necessary. Drainage diversions and water-disposal facilities should also be checked and maintained regularly. During the life of the contract, contract administrators are responsible for the inspections.

2. **Management Practice** -- Post-sale inspections can be most easily be accomplished by tracking high risk areas through the Forest's Total Resource Inventory (TRI) system. Areas of high risk or areas where additional work may be necessary, such as machine constructed firelines on cable ground, should be identified by the TSA on the silvicultural TRI card. Silviculture can copy the card and forward to the district watershed representative(s). The watershed representatives will be responsible for high risk area data management and for ensuring that periodic inspections are accomplished. Where necessary, remedial treatments should be prescribed.

3. **Management Practice** -- Follow-up inspections are necessary until soils are stabilized. Inspection should be made in the fall, early spring and at any time following heavy summer rainstorms. Inspections will indicate whether or not the area is handling water properly. Check the following on each timber sale area and if deficiencies are found take immediate corrective action. (From: Technical Guide for Erosion Prevention and Control on Timber Sale Areas. Intermountain Region. Soil and Water Management, April, 1979.)

1. Are cross-ditches effective in preventing road surface erosion? Is the ditch tied firmly to the cutbank? Is the outlet open?

2. Are water disposal facilities preventing accelerated erosion? Are sediment traps effective?

3. Are water retention dams of adequate capacity to hold road surface runoff?
   Is the spillway adequate? Have dams been breached?

4. Have all temporary bridges and culverts been removed? Have drainage-ways been cleared to their original gradient?

5. Are present water diversion structures protecting fill areas?

6. Are culvert inlets open? Are culvert outlets adequately protected?

7. Are stream channels clear of logging debris?

8. Are high cuts and fills stabilized?

9. Is vehicular travel damaging erosion control structures?

10. Has channel stability changed due to water yield increase?

H. MEADOW PROTECTION DURING TIMBER HARVEST

1. **Management Practice** -- Vehicular or skidding traffic shall not be used on or in meadows, springs, seeps or bogs except where roads, landings, and tractor roads are designated and approved on sale area maps and/or the ground. Unless otherwise agreed, trees felled in meadows shall be removed by end lining and logging slash will be removed, where necessary to protect cover, soil and water.

2. **Management Practice** -- Damage to meadows or streamcourses caused by unauthorized purchaser's operations shall be repaired by the purchaser in a timely and agreed manner.

Administration -- B6.61, C6.6#

I. CONTRACT MODIFICATION AND SPECIAL C PROVISIONS

Management Practice -- If new evidence raises serious concerns that irreversible watershed damage will result if the timber sale is implemented as planned an IDT will assess the evidence and implications. The EAR prepared for the timber sale will then be amended to reflect the findings of the ID team. The team will make recommendations to the appropriate Line Officer on whether the sale as currently planned will: 1) irreversibly damage soil, water or watershed conditions and 2) will make appropriate recommendations concerning required changes or mitigation necessary to implement the plan.

Special C provisions may be needed to management objectives on a particular sale area. Examples include C6.4 (Opt.3)-subsoiling, swing yarding and directional falling requirements. These special needs should be identified within the IDT process.

Administration -- B8.32

ROAD DESIGN AND MANAGEMENT ACTIVITIES

ROAD DESIGN AND MANAGEMENT ACTIVITIES

(Stream Classes I, II, III and IV and the term SMU are referred to often in this section -- for definitions of these terms see chapter on Watershed Management Practices Exclusive to Streamside Management Units, A. and B.)

A. MASTER OBJECTIVES

Objectives covering all of the management practices that follow in this section are:

-- "Hold soil in place on constructed roads and prevent silt movement into streams " (FSH 7709.11, D4--1, R-6).

-- "Road drainage should be discharged where sediment can settle out before reaching a stream channel. Sediment collection basins should be constructed if necessary" (FSM 2482.3--6, R-6. Ch 80 now being revised).

-- (On Temporary Roads) "particular care must be taken to ensure adequate drainage during use" (FSM 2482.3--7, R-6. Ch 80 now being revised).

Unless stated otherwise, administration of the management practices is thru engineering design and implementation of contracts.

B. ROAD LOCATION AND DESIGN CONSIDERATIONS

Management practice -- Use the following guide:

1. Locate roads out of the riparian management zones where practical alternatives exist. The riparian management zone extends out 60 to 100 feet away from Class I, II and III streambanks. (For further definition of this zone see chapter on Watershed Management Practices Exclusive to Streamside Management Units, section G.)

2. After considering the above criteria, locate roads to protect the fillslopes from flood erosion -- floods may extend out to farther than the edge of the riparian management zone.

3. Locate ridge-top roads to avoid headwalls. Headwalls are upland concave depressional areas that are the source of tributary drainages and/or the head of slump basins.

4. Take advantage of benches, ridge tops and flatter transitional slopes near ridges and valley bottoms. Avoid midslope locations on steep, unstable slopes.

5. Select stream crossings carefully to take advantage of most effective and least expensive drainage techniques. One beneficial design practice is to keep road grades to a "minimum" when approaching or within SMU's (Ref. FSH 7709.56b-Drainage Structures Handbook). Additional considerations are keeping road distances within the SMU short and picking the best sites and methods for water diversion during stream crossing construction. Other management practices in this chapter dealing specifically with SMU's will provide additional guidance.

6. Place all surface cross-drains to avoid discharge onto erodible (unvegetated) slopes or directly into stream channels. Provide a buffer or sediment basin between the cross-drain outlet and the stream channel. Install cross-drainage culverts immediately upgrade of headwalls.

7. Design stream drainage structures to accommodate streamflow based on **Drainage Structures Handbook 7709.566b**, with due consideration given to the possibility of bedload and debris restricting flow capacity of the structure. **Consideration for the impact of future harvest activities on culvert sizing involves peakflow analysis. This analysis looks at existing and proposed harvest activities and predicts changes in peakflows. See Appendix B. for peakflow analysis procedure.**

8. Unless otherwise permitted, minimize the number of heavy equipment (all vehicles) crossings of a live stream to the minimum necessary to complete the culvert installation. Temporary crossing structures may be used but the same restrictions apply. Generally, the maximum number of crossings needed per installation on smaller streams is three or less. Construction will not proceed beyond live stream crossings until either a permanent or temporary crossing structure, capable of controlling sedimentation, is in place.

C. ADDITIONAL LOCATION AND DESIGN CONSIDERATIONS FOR SENSITIVE CONSTRUCTION AREAS

See chapter on Watershed Management Practices Exclusive to Streamside Management Units - Practice K. 2. for timing constraints associated with road use and construction within sensitive SMU areas.

Management Practice -- For Temporary Road construction in sensitive construction areas, special construction requirements should be specified to safeguard water quality. (Sensitive areas are defined in the citation in the previous paragraph.)

Administration -- C5.1 (Option 2)

-- Is thru contract provision C5.1 (Option 2). The following should be added to the "prohibited" specification of paragraph 4: Log corduroy or fording is not permitted. Using ditch and ditch relief culverts, and insloped and outsloped surfaces without drainage dips or other surface cross-drains is prohibited.

-- The spacing required for surface cross-drains to assure compliance with provisions of C5.1 (Option 2) is found in the table in section D. The criteria specified in section F. should also be considered when evaluating Purchaser's proposed temporary plans for approval.

D. SURFACE CROSS-DRAIN SPACING GUIDE WITHIN SMU'S

Management Practice -- Within SMU's, when surface cross-drains are to be installed on a non-crushed rock road surface or pitrun or grid-rolled material not qualifying as Unified soil class GW or GP with less than 25 percent fines, the following guide should be used for determining spacing:

Typical Surface Cross-Drain Spacing (feet)

Road Grade (%)	Native Material Surface (no natural surfacing). Limited Strength Surface — Soil Erosion Group 1/				Pitrun or Grid-Rolled (or existing natural surfacing) Extended Use Surface 2/ — Soil Erosion Group			
	1	2	3	4	1	2	3	4
2	140	125	105	75	205	185	160	115
4	120	110	90	60	185	170	140	90
6	115	100	80	50	170	155	125	80
8	105	95	75	45	160	140	115	70
10	100	85	65	35	145	130	100	55
12	90	75	55	30	135	115	85	40
14	80	65	45	30	120	100	70	30
16	70	55	40	30	110	85	55	30
18	65	45	30	30	95	70	45	30
20	55	35	30	30	85	55	30	30
22	45	30	30	30	75	45	30	30
24	35	30	30	30	65	35	30	30
26	30	30	30	30	50	30	30	30

1/ If soil group is not given by soil scientist, use the following based on the geologic type:

Group 1--metasediments, metavolcanics, hard shale
Group 2--basalt, andesite, quartzite, hard matrix conglomerate, rhyolite
Group 3--granite, sandstone, andesite porphyry, glacial and alluvial deposits, soft matrix conglomerate
Group 4--volcanic ash (on running surface), pyroclastics

2/ If pitrun or grid-rolled material qualifies as Unified soil class GW or GP with 25 percent or less fines (or if surfacing is crushed rock), engineers should use their ordinary guides for determining spacing. A copy of the Unified classification scheme is included in Appendix D.

Other rules or information for using guide:

-- Surface cross-drains are drainage dips, Utah dips, opentops, waterbars or similar devices -- not ditch relief culverts as these are not effective on surface types less than GW/GP in preventing wet weather rutting. Drainage dips are the best devices although often other types must be added in between them to be able to achieve the desired spacing.

-- When a road is within 25 feet of a stream and parallels stream for more than 300 feet, decrease spacing by 1/4.

-- Where a road is grading down towards a stream, locate the last cross-drain at about 10 to 30 feet from stream (depending upon filtering capability where it spills out); place the next upgrade one at about 3/4 guide spacing.

-- If road has an inside ditch, extending cross-drains to intercept its runoff usually is desirable.

-- When design engineer feels that the calculated spacings are too narrow to be feasible, either add pitrun, grid-rolled or crushed rock, reduce road grade in the SMU, relocate road crossing, or contact watershed specialist or District watershed representative for other drainage design techniques.

Administration is thru road construction specifications or timber sale contract provisions that deal with specifications for drainage. See Appendix E. for Rationale for Surface Cross-Drain Guide.

E. SURFACE CROSS-DRAIN INSTALLATION ON NEW CONSTRUCTION AND RECONSTRUCTION ROADS

Management Practice -- Within SMU's, all new and reconstructed roads which will not have a surface of crushed rock or GW or GP Unified soil group should have surface cross-drains 1/:
- -- prescribed as part of road engineering design, and
- -- spaced according to section D. guide, and
- -- in place before the road can be called Substantially Completed.

1/ see surface cross-drain definition under section D. above.

Administration -- If an existing road with less than a GW/GP surface does not have properly spaced surface cross-drains, heavier log truck use during probable wet periods (after September 15) will result in increased risk of streamcourse sedimentation. Deeper and more numerous wheel ruts are very likely to form -- ruts as small as one inch deep are significant in redirecting water away from any road bearing surface, in- or outslope. Thus it is appropriate to reconstruct or otherwise provide for additional surface drainage.

F. SURFACE CROSS-DRAIN INSTALLATION ON TEMPORARY ROADS

Management Practice -- Within SMU's, all Temporary Roads with grades greater than two percent should:
- -- have a drainage dip or open-top (not a Utah dip or drivable waterbar) installed at approximately 10 to 30 feet from streamcourse on each side before road is used for timber removal, and
- -- have remaining surface cross-drains installed and spaced according to this chapter's section D. guide. Cross-drains must be kept functional after September 15 and during the "seasonal weather, precipitation and/or runoff" periods.

Administration is thru contract provisions B5.1 or B6.62. For Sensitive Construction Areas, C5.1 will be used (see this chapter's section C.). The primary objective for the first "--" practice is to help protect against the effects of high-intensity, summer rainstorms.

G. SURFACE CROSS-DRAIN INSTALLATION WITH NON-RECONSTRUCTED EXISTING ROADS

Management Practice -- Within SMU's, existing roads which meet all of the following criteria should have surface cross-drains installed before timber sale is finished. Spacing will be according to SMU spacing guide prescribed in section D.

1. Will be used by Purchaser during sale.

2. Will not be "reconstructed" as part of timber sale procedure.

3. If an open road, has been identified by EA process as having a potential for drainage problems due to increased amount of heavy traffic.

4. If a closed road that will be opened, does not have surface cross-drains installed at section D. specifications.

5. Does not have a crushed rock or GW/GP surface within SMU.

Administration may be attained thru contract provisions C5.43 (or C5.42) and associated Maintenance Specifications to get cross-drains in place in accordance with section D. cross-drain spacing guide. Cross-drains must be in place prior to periods of anticipated seasonal runoff, and left in place after Purchaser's use is finished.

H. INSIDE DITCH SEDIMENT CATCH BASINS

Management Practice -- Within SMU's, all new and reconstructed roads that have or will have inside ditches emptying within 75 feet of streamcourses should have sediment catch basins installed at the ditch outlet or at the end of a ditch relief culvert. If possible, existing roads should also have them added. This is not needed if there are natural catch basins already existing, or if surface cross-drains are to be installed that are to intercept ditch and be spaced as prescribed by Section D.

Administration is through road construction specifications. For new roads, sediment catch basins can be installed relatively cheaply during the first phases of construction. On existing roads, hand or backhoe construction of simple ditch depressions and berms will often be very effective.

I. LIMITED STRUCTURAL STRENGTH SURFACE

Management Practice -- Within SMU's, all roads that have limited structural strength should not be used by Purchaser when "damage" occurs. Following is the watershed definition of "contributing to damage of streams" for use in administering contract provisions, such as C5.124. The intent here is to provide an aid to contract administrators.

- -- A road condition that results in muddy road surface runoff reaching a stream channel (Class I through IV stream).

- -- Allowing travel surface to form ruts that do or will lead runoff water farther than 30 feet down road without having drainage dips, Utah dips, or similar surface devices in place according to section D. spacing guide. (Don't be concerned about this stipulation if there are already correctly spaced cross-drains on road).

- -- If surface cross-drains are in place, allowing use that renders them ineffective for leading runoff to the side of the road.

Administration is through contract provision C5.124.

J. SEASONAL PERIOD OF PRECIPITATION

Management Practice -- For SMU's, the guideline to apply for determining when "seasonal weather, precipitation, and/or runoff" (as used in C5.42, C5.43, B6.6 and others) has begun shall be chosen from either one of the below):

- -- The period is between September 15 and June 15.

- -- For the few weeks before and after the above dates the seasonal period is indicated by the occurrence of either of the following:

    - -- Formation of wheel ruts or eroded channels on roads that do or will lead runoff water farther than 30 feet down road.

    - -- Conditions on a road that result in turbid road surface runoff reaching a stream channel (Class I through IV).

Administration -- This guide is for sale administrator's use.

K. PIONEER CONSTRUCTION

Management Practice -- Use the following guide for pioneer construction:

1. For direction concerning possible construction timing restrictions, see Watershed Management Practices Exclusive to Streamside Management Units, section K. 2.

2. Construction of pioneer roads should be confined to the roadway construction limits unless otherwise approved by the ER or COR.

3. Pioneering should be conducted so as to prevent undercutting of the designated final cutslope and prevent avoidable deposition of materials outside the designated roadway limits. When light trucks are being used, temporary culverts or log crossings at streamcourses should be used. With heavy construction equipment, the permanent crossing structure must be in place before the equipment moves on beyond the crossing area. (See this chapter's Management Practice B. 8. for details.)

4. Erosion control work should be kept current. Temporary erosion control structures or devices should be in place before contractors are released from an area for an extended period of time -- 2 weeks or longer. Especially important is that surface drainage be in place prior to fall rains and winter weather -- within SMU's after September 15.

5. Generally all live streams in Sensitive Construction Areas crossed by pioneer roads should be dewatered by approved diversion devices. Project location bypass design, and detailed mitigative measures should be developed to protect fisheries and other downstream uses. Areas requiring special water diversion practices will be identified in project EA's.

L. ROAD MAINTENANCE

Management Practice -- Custodial care is necessary to protect the road investment and to minimize damage to local streams and adjacent resources. This level of maintenance requires an annual inspection, on Level I roads which have a history of road erosion or drainage problems, to determine what work, if any, is needed to keep drainage functional and the road stable. As a minimum measure, maintenance must protect drainage facilities and runoff patterns. All other Level 1 roads should be inspected on a recurring basis (every 5 years).

Administration -- C5.42, C5.43

M. WATER SOURCE DEVELOPMENT

Management Practice --

-- Water source development should aim toward the construction of durable, long term water sources (under the Sale Area Improvement Plan) rather than construction of a succession of hasty, expedient developments. Permanently designed sources, such as tanks, will result in the lowest, long term impact to the affected streams.

-- Overflow from water holding developments should be piped directly back to the stream. Streambank excavation should be kept to a minimum needed for entry and exit, and should be rocked if appropriate.

Administration -- B1.1, B6.22

N. TRAFFIC CONTROL

Management Practice -- Roads that must be used during wet periods should have a stable surface and sufficient drainage to allow such use with a minimum resource impact. Adding surface cross-drains, rocking, oiling, paving, and armoring of ditches are measures that may be necessary to protect the road surface and reduce sedimentation. ID teams should consider closing roads not needed for public access or administrative use. These closures will serve watershed and wildlife objectives and will reduce maintenance costs. Road management objectives should be included in all project designs. ID team is responsible for developing project area road management strategies.

Administration -- C5.232#- Critical Construction Areas, C5.124(OPT1)

O. EROSION CONTROL PLANS

1. **Management Practice** -- Detailed mitigation plans should be developed by an ID Team and identified in the project environmental assessment. Design engineers should incorporate these approved mitigation measures in the engineering design and contract documents.

2. **Management Practice** -- To meet acceptable levels of soil loss and soil management objectives, the minimum percent effective ground cover following the cessation of any soil disturbing activity should be:

	Minimum Percent 1/ Effective Ground Cover	
Erosion Hazard Class	1st Year	2nd Year
Low (very slight or slight)	20-30	30-40
Medium (Moderate)	30-45	40-60
High (Severe)	45-60	60-75
Very High (Very Severe)	60-75	75-90

1/ These recommendations are taken from FSM 2520.

P. SNOW REMOVAL CONTROLS

Management Practice -- The following should be employed on forest roads being used during the winter:

1. Snow removal should be conducted in a manner which will protect roads and adjacent resources.

2. Rocking or other special surfacing and/or drainage measures may be necessary to prevent road deterioration and/or road erosion.

3. Snow berms should be removed or placed to avoid accumulation of melt water on the road and to prevent water concentration on the road or erosive sideslopes or soils.

4. Road must be properly shaped prior to winter freeze-up in order to avoid trapping melt waters within road ruts.

Administration -- C5.43

Q. CLOSURE/OBLITERATION OF PERMANENT OR TEMPORARY ROADS AND TRAILS

One objective of road closures is to prevent casual use in order to minimize sediment production and to protect the road investment.

The objective of road obliteration is to effectively mitigate past impacts in order to put the area back into vegetative production.

Management Practice -- Closure or obliteration should be achieved by applying one or more of the following measures:

Road Closure

1. Barricading or blocking of the road surface: gates, guard rails, earth barricades or tank traps, logging debris or a combination of the above.

2. Installation of waterbars, cross drains or dips if not already on road.

3. Seeding for erosion control.

Road Obliteration

1. Subsoiling roads and trails using a winged subsoiler to remove ruts, berms and ditches, while leaving or replacing surface cross-drains structures.

2. Removal of stream crossing drainage structures and in-channel fill material. (See this chapter's Management Practice C. for safe time period criteria.)

3. Seeding and/or planting for erosion control and site rehabilitation.

R. BORROW PITS AND QUARRIES

Dust control during pit operations may be required in sensitive watershed areas to prevent sedimentation.

Objective -- Restoration of borrow pits and quarries may be necessary to minimize sediment production and improve visual quality in these areas.

Management Practice -- Restoration can most easily be accomplished if the following guidelines are adhered to:

1. Wherever possible, prior to excavation of the site, topsoil should be removed and stockpiled for surface dressing in the post-operation rehabilitation period.

2. Pit sides should be stabilized and the general pit area smoothed. Oversized material should be evenly distributed and finer material should be spread over the bottom of the pit prior to spreading stockpiled or imported top soil (applies to pits where future production is not planned).

3. Seeding and mulching should be used to minimize erosion and noxious weed invasion and improve the visual quality of the area.

4. On rock pits where no future entry is anticipated, access roads to the site should be ripped or subsoiled, drained, blocked to traffic and seeded.

SITE PREPARATION -
WATERSHED RESTORATION

SITE PREPARATION AND WATERSHED RESTORATION

A. PRESCRIBED FIRE GUIDELINES FOR USE IN SMU's

Refer to the chapter Watershed Management Practices Exclusive to Streamside Management Units, Practice I for burning guidelines within SMU's

B. GENERAL PRESCRIBED AND NATURAL FIRE GUIDELINES

For Site Preparation, Hazard Reduction, Wildlife and Range Improvement, Wilderness and Natural fires.

In order to achieve the maximum benefit from the use of fire, there is a need to specify the desired result(s) and then tailor the burn prescription to meet those results. The parameters currently in use as guidelines are soil and duff moisture. These can be measured directly or correlated to the National Fire Danger Rating System measurements of the adjusted 1000 hour fuels, as recorded by the remote automated weather stations.

Objectives To maintain long term site productivity by maintaining the protective capacity of the forest floor, excluding silvicultural objectives. This is measured as duff consumption or exposed mineral soil.

Management Practice: To protect the productivity of the soil it is recommended that burn units be lightly burned; that is, less than 2% of the burned area should be severely burned and less than 15% moderately burned (see description below for visual characteristics of burn intensity).

Standards:

A. No more than 50% of the duff shall be removed on 80% of the area as a result of the prescribed fire and/or

B. No more than 40% bare ground exposed on soils of low to moderate erosion potential and/or

C. No more than 30% bare ground exposed on soils of high erosion potential and/or

D. No more than 15% bare ground exposed on soils of very high erosion potential.

Guidelines: Different Levels of Burn Intensity

Visual Characterization	Site Specific Results	Proportional Area
Light burn	The surface duff layer is often charred by fire, but not removed. Duff, crumbled wood or other woody debris is partly burned, logs not deeply charred.	Less than 2% is severely burned. Less than 15% is moderately burned.
Moderate burn	Duff, rotten wood or other woody debris partially consumed or logs may be deeply charred but mineral soil under the ash not appreciably changed in color.	Less than 10% is severely burned. Over 15% is moderately burned.
Severe burn	Top layer of mineral soil significantly changed in color, usually to reddish color; next 1/2 inch blackened from organic matter charring by heat conducted through top layer.	More than 10% is severely burned. More than 80% is moderately burned. Remainder is lightly burned.

Guidelines: Soil moisture guidelines for prescribed burning are listed below. Duff moisture should be at 60% or greater.

It appears that the work of Sandburg and Ottmar (1983) is applicable to eastside duff conditions. This is based on preliminary results from current east-side consumption studies (Ottmar, 1987). It is recommended that this work be used when building burning prescriptions to meet these duff and exposed soil standards.

C. SOIL MOISTURE RECOMMENDATIONS FOR PRESCRIBED UNDERBURNING

FUEL SIZE/LOADING 0-3" SIZE CLASS	TOTAL FUEL LOADING	ANTICIPATED FIRE BEHAVIOR	RECOMMENDED MINIMUM SOIL MOISTURES
0-13 TONS/ACRE	15 T/A OR LESS	LOW TO MODERATE INTENSITY, SHORT DURATION, 2-4 FOOT FLAME LENGTHS	15 %
	15-25 T/A	MOD TO HIGH INTENSITY AND DURATION 4-6 FOOT FLAME LENGTHS	25%
	25-35 T/A	POTENTIAL FOR HIGH TO VERY HIGH INTENSITIES AND DURATION GREATER THAN 6' FLAME LENGTHS.	30% +
	35-50 T/A	AS ABOVE FOR 25-35 T/A	35% +
13-25 TONS/ACRE	25-35 T/A	AS ABOVE	30% +
	35 T/A +	AS ABOVE	35% +
RANGE LAND FORAGE ENHANCEMENT UNDERBURNING: MINIMUM SOIL MOISTURES FOR ALL SOIL TYPES. LITTLE TO NO WOODY FUELS.			
0-5 TONS/ACRE	0-5 T/A	LOW-MOD INTENSITY SHORT DURATION 2-4 FOOT FLAME LENGTHS	10% +

The above values are suggested minimum soil moistures to achieve duff consumption and exposed soil objectives.

D. MECHANICAL SLASH TREATMENT GUIDELINES

The use of mechanical treatments has a high potential for damage to both the protective capacity of the forest floor and the productivity of the soil, primarily through compaction and displacement. The typical mechanical treatments are: crushing, grapple pile and burn, and brush blade pile and burn. The order of potential damage would list brush piling the highest and crushing the lowest.

Objective: To reduce the risk of soil damage due to compaction, displacement and high burn intensity.

Standards: No more than 2 percent of the area, as defined previously, should be severely burned.

Management Practices:

1. Construct as small diameter piles as possible.
2. Pile small material (3-8" size predominantly).
3. No windrows greater than 20 feet in length.
4. Avoid piling concentrations of large logs and stumps.
5. Burn piles when soil moisture is high (35% or more).

Standard: No more than 20 percent of the activity area will be detrimentally compacted or displaced.

Management Practices:

1. Use the lowest ground pressure machine capable of meeting objectives.
2. Leave some slash on the ground to help cushion the vehicle.
3. Make only one pass over a piece of ground.
4. Keep the brush blade at least 6" off the ground.
5. Operate when soil moistures are low (July 15-Sept 30).
6. Restrict the amount of sideslope activity to minimize soil displacement.
7. Rehabilitate detrimentally compacted areas to maintain site productivity.
8. Waterbar and erosion control seed where necessary. See erosion control guidelines in section D. of the Sale Administration chapter.
9. When working within SMU's, follow bare soil (and other) criteria found in section I of the Watershed Management Practices Exclusive to Streamside Management Unit chapter.

E. REHABILITATION ON ROADS AND TRAILS

Management Practice --Rehabilitation is any technique employed to improve degraded soils. Normally, rehabilitation is prescribed when roads, landings and skidtrails occupy greater than 20% of an activity area or where roads, landings and skidtrails are not needed for future entries.

Objective -- The objective of rehabilitation/restoration is to put the land back into production.

Administration -- Soil rehabilitation can be accomplished contractually by implementing contract provision C.6.4#(opt. 3). This provision requires subsoiling with a winged subsoiler.

Management Practice -- Acceptable subsoil mitigation results in:

80% of the compacted zone being fractured.

80% of the fractured material should be in clods of 6" or less in size.

This is to be accomplished in conjunction with implementing road management objectives. **Specific techniques are identified under Section Q : Road Management- Road Closure/Obliteration Measures.**

F. WATERSHED RESTORATION INVENTORY - KV PLANS

Management Practice -- When new timber sales are planned, watershed restoration projects should be identified in Sale Area Improvement Plans. All potential watershed improvement projects should be identified on a District Watershed Improvement Needs inventory. District inventories will be combined at the Forest level and watershed restoration money will be allocated based on needs identified in restoration plans. See Appendix G for list of potential KV projects.

WATERSHED PRACTICES
FOR MINING

WATERSHED PRACTICES FOR MINING

A. **Management Practice** -- Areas disturbed by mining activities, within 100 feet of Class I, II, or III streams or other perennial water bodies, should be restored by the operator with a goal of stabilizing the site comparable to the pre-activity condition. This restoration needs to occur whenever the operator is finished with an area. Restoration should be an on-going part of his operation. An inventory of existing conditions should be performed by the Forest Service before approval of the operating plan is given. If this is not possible, then the inventory shall be performed before mining operations begin, with an amendment made to the operating plan.

This inventory will determine:

(a) densities of tree, riparian brush (alders, willows, etc.), non-riparian brush, and herbaceous vegetation.

(b) fish habitat suitability (expressed as percent of habitat optimum). The inventory method used will be Cow-Fish or other similar one. 1/

As part of the restoration process, the mining operator should be required to:

(a) within 10 feet of streambank, plant riparian brush at spacings needed to achieve the original density, except when this would require spacings closer than 2 feet--in this case the 2 foot spacing instead becomes the standard. When openings caused by mining exceed 2-1/2 times the adjacent tree height, planting of trees may also be required.

(b) plant grass to achieve a density at least equal to the total of the original herbaceous plus non-riparian brush types. Additional density and type of planting will be determined by the need for erosion control, while attempting to allow sufficient openings for natural revegetation by trees.

Planting will be rated successful if:

(a) for riparian brush, 75% or more of the brush has survived one year after treatment.

(b) for grass seeding, 90% or more of the plantable area has at least two live plants per square foot one year after planting.

As part of the restoration process, the mining operator may be required to:

(a) utilize a temporary fence, plastic tube seedling protectors, or similar devices to exclude livestock from the planted area -- if needed for protection from livestock grazing.

(b) place whole trees, construct habitat enhancement structures, or perform comparable improvements within the stream channel at a density required to bring the fish habitat suitability index up to

the same value that existed before the mining operations began -- will be needed if instream work has disrupted the fish habitat suitability index by five or more percentage units.

The estimated costs of the above operator requirements shall be incorporated into the value of the operator performance bond.

B. **Management Practice** -- When areas within 100 feet of Class IV streams and ephemeral draws are disturbed by mining, they shall be evaluated and restored as above except that the fish habitat criteria will not apply.

For both A. and B.:

Objective -- Provide for the eventual restoration of the site to a condition that is the same or comparable to what existed before the mining activity occurred.

Administration is described within the Practice text.

1/ Lloyd, James R. Cow-Fish, Habitat Capability Model. U. S. Forest Service, Northern Region, Box 7669, Missoula, Montana 59807. June 1986.

WATERSHED PRACTICES FOR RANGE MANAGEMENT

WATERSHED PRACTICES FOR WETLANDS, FLOODPLAINS

(Reserved)

(reserved)

WATERSHED PRACTICES -
MONITORING & FEEDBACK

WATERSHED PRACTICES FEEDBACK

The purpose of this chapter is to provide pages following that a user may fill in to document recommended changes to these watershed management practices. Periodically (no less than a year) S.O. Watershed will put out a call for what you have on these pages. Individual practices may change due to: watershed monitoring results; improved harvest techniques or equipment; improved contract language and/or flexibility; improved planning, contract preparation and layout of units; and practical considerations which have been overlooked that could limit the application of these practices.

APPENDIX

APPENDIX

A. STREAM TEMPERATURE/LIGHT INTENSITY CALCULATION

The following procedure may be used when determining allowable light intensity increases near Class I, II and III streamcourses.

Maximum Increase In Light Intensity (Percent)
(Pristine Light Intensity minus Light Intensity After Cutting)

Stream Class	Average Stream Depth (Feet)										
	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75
III (4 deg. F. rise)	4	10	14	--------(no III's this deep)----------							
II (2 deg. F. rise)	2	5	7	9	12	14	17	19	21	24	26
I or II (1/2 d rise)	1	1	2	2	3	4	4	5	5	6	7

-- For II streams, use the 2 degree line if the maximum existing stream temperatures are never higher than 65 degrees Fahrenheit, and the 1/2 degree line if they rise above 65 degrees. If data does not exist, assume stream has a 65 or less rise if the present maximum light intensity increase meets the table standard. (Actually if the present condition does not meet the standard, no cutting should be taking place anyway.)

-- Average stream depth -- This is the depth during the stream's lowest summer flow period -- August if perennial or an "in-and-out" stream. For streams completely dry by August, use 1 foot depth. This depth can be a random sample average or an average weighted by percent pool and percent riffle (example: 30% pool with 1 foot average depth and 70% riffle with 1/2 foot depth equals (.30 x 1) + (.70 x 1/2) = 0.65 feet weighted average depth or (for table use) 0.75 feet). If field depth data is not obtained, use 0.75 feet as a default value or 0.25 foot if stream is dry in August.

To be able to utilize the above table information, the percent light increase objectives have to be converted into basal area per acre values for the riparian management zone tree stands. The following is the process:

(1) First determine the ecological plant (tree) association and its related Total Basal Area (TBA) value from Hall's and Johnson's publications. The mean TBA value can be assigned for a medium site index site; the low value of the range in TBA values for low site classes and the high value for high site classes. (This is a critical step that determines how much the stand can be cut--be as accurate as possible.)

(2) Determine the percent class of small crowned trees within the stand. Small crowned trees are western larch, Douglas-fir, lodgepole pine and ponderosa pine. Large crowned trees are grand fir, alpine fir and Englemann spruce.

(3) Enter the TBA value into one of the following equations and solve for the amount of light reaching the stream surface after passing thru an unentered (pristine) stand. Ignore any brush shade that may be present. Brush density/shade varies too much in relation to tree shading changes -- it is not a constant over the many decade time frame assumed in managing riparian management zone shade.

--0 to 33% of stand is small crowned trees:

$$\% \text{ Light} = 100e^{-0.00974 \times \text{Basal Area}}$$

--34 to 67%:

$$\%L = 101e^{-0.00669 \times BA}$$

--68 to 100%:

$$\%L = 101e^{-0.00494 \times BA}$$

Notes:
-- % Light is percent of full sunlight.
-- Basal Area is in units of square feet per acre within the riparian management zone.

(4) Add the % Light value determined in (3) to the maximum light increase objective obtained in the previous table. This total is the % Light that can be permitted to come thru the stand after logging takes place.

(5) Enter this total % Light value into one of the following equations to get the associated average basal area of the stand after cutting:

--0 to 33% of stand is small crowned trees:

Basal Area per acre = [ln(%Light divide 100)] divide -0.00974

--34 to 67%:

BA = [ln(%L divide 101)] divide -0.00669

--68 to 100%:

BA = [ln(%L divide 101)] divide -0.00494

Further Notes --

In the paragraph below, I am assuming that there is only one plant association (tree type) along the stream. Also I am using "stand" to mean a single plant association that is a group of trees that is kept track of, managed and cut as an integral unit.

The basal area value calculated in step (5) is the minimum average value that should exist for the combination of all stands within the riparian area as it extends for the total length of the I, II or III stream. For planning purposes this average basal area objective can be assumed to be either (1) a value that no individual stand can fall below, or (2) a value

that is a weighted average -- that is, some stands can go below this value if compensated by other stands that are above this basal area value:

The (1) planning scheme is easier to administer over a long period of time but may yield smaller timber commercial volumes -- the ease of planning may be worth the falldown though.

The (2) planning scheme requires keeping track of and knowing existing basal area of many different stands along the stream whenever designing for a new entry -- all stand conditions must be assessed each time.

If more than one plant association (tree type) exists along the stream, then the above procedure must be performed for each, unless each stand has close to the same total basal area (TBA) value--in which case the associations could be considered the same.

B. PEAK STREAMFLOW ANALYSIS

The following procedure is used for determining changes in peakflows due to increases in openings caused by timber cutting or fire.

For each subwatershed (at least perennial stream ones), the tables starting two pages away are first entered with values representing the percentage of the total area of each aspect that has natural openings. For this procedure, consider any non-CFL land to be a natural opening (even if trees exist) -- consider it to be the same as a clearcut. This step provides a simulation of the baseline or pristine condition when all tree stands are at maximum volume density. Use interpolation and record the streamflow value found from the table -- this is the baseline condition.

In order to assess the peakflow effects of new harvest, enter the tables again with the combined percentage value for natural openings plus created openings. Do this for each vegetative condition of interest -- at least for each alternative in an environmental analysis. Don't forget to include past logged stands as part of created openings. Use interpolation and record the streamflow value found in the table -- this is the altered condition.

When an opening created by logging is not a clearcut, a mathematical correction must be performed to convert its size area to a clearcut area equivalency. Use the following table to determine the Clearcut Equivalency Factor. Multiply this factor times the created opening acreage to get the clearcut area equivalency. This resulting acre value can then be added to the acreage of authentic clearcuts when determining total percent of watershed impacted.

Plant association				
Ponderosa pine		Other		
Stand age(yrs)	Basal area range (sq-ft/ac)	Stand age(yrs)	Basal area range (sq-ft/ac)	Clearcut equivalency factor
0-10	0	0-5	0	1.0
15	1-9	10	1-4	.9
20	10-19	15	5-18	.7
25	20-31	22	19-36	.4
28	32-46	28	37-58	.2
30	47+	30	59+	.0

Consider an HSH treatment to have the basal area that it will have after the overwood is removed -- it will be gone in just a few years more with the HFR.

Subtract the baseline streamflow value from the altered streamflow value, divide by the baseline value and multiply by 100 to get the percent change in streamflow relative to baseline/pristine conditions. (By changing the divisor from the baseline to the existing condition value, EA alternatives relating to the existing condition also can be determined, altho this isn't very useful in an EA.)

There are limits to what streams can safely handle in terms of increased peakflows. Use the following table to determine what this limit is. Then match it to the percent change relative to baseline determined from the previous procedure. If the percent change is higher than the value obtained from the table below, then this means the EA alternative is infeasible -- would result in significant, often irreversible (100's of years if bad), detrimental stream channel damage. When the analysis shows this then either redesign alternative's cutting unit layout or perform the more accurate WET hydrologic computer program.

Maximum Allowable Change for Highest 6-Day Streamflow Period (Percent)

North aspect	Stable streambanks (%)				
(% of subwatershed)	0-42	43-60	61-72	73-83	84-100
25% or less	-5	0	5	10	15
greater than 25%	-6	-2	2	6	10

INCHES OF STREAMFLOW FOR HIGHEST 6-DAY PERIOD FLOW PERIOD
30 INCHES PRECIPITATION ZONE

North Aspect -- 0% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South Aspect % Clear-cut or Equiv-alent	0	1.73	1.71	1.69	1.66	1.69	1.74	1.76	1.75
	10	1.69	1.67	1.65	1.62	1.67	1.71	1.73	1.72
	20	1.65	1.63	1.61	1.59	1.64	1.69	1.70	1.70
	30	1.62	1.59	1.57	1.56	1.61	1.66	1.67	1.67
	40	1.58	1.55	1.53	1.53	1.58	1.64	1.67	1.68
	50	1.55	1.51	1.49	1.50	1.55	1.64	1.67	1.69
	60	1.54	1.50	1.48	1.49	1.54	1.64	1.67	1.69
	70-100	1.53	1.49	1.47	1.48	1.53	1.63	1.67	1.68

North Aspect -- 10% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South Aspect % Clear-cut or Equiv-alent	0	1.77	1.74	1.72	1.70	1.75	1.80	1.81	1.81
	10	1.73	1.70	1.68	1.67	1.72	1.77	1.78	1.78
	20	1.69	1.66	1.64	1.64	1.69	1.74	1.75	1.75
	30	1.65	1.63	1.60	1.61	1.66	1.71	1.73	1.74
	40	1.61	1.59	1.56	1.58	1.63	1.70	1.74	1.75
	50	1.57	1.55	1.52	1.55	1.60	1.71	1.74	1.75
	60	1.56	1.54	1.52	1.55	1.60	1.71	1.74	1.75
	70-100	1.55	1.52	1.50	1.53	1.59	1.70	1.73	1.74

INCHES OF STREAMFLOW FOR HIGHEST 6-DAY PERIOD FLOW PERIOD
30 INCHES PRECIPITATION ZONE

North Aspect -- 20% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South	0	1.80	1.78	1.76	1.75	1.80	1.85	1.86	1.86
Aspect	10	1.76	1.74	1.72	1.72	1.77	1.82	1.83	1.83
%	20	1.72	1.70	1.68	1.69	1.74	1.79	1.81	1.81
Clear-cut	30	1.68	1.66	1.64	1.66	1.71	1.77	1.80	1.81
or	40	1.64	1.62	1.60	1.63	1.68	1.77	1.80	1.81
Equivalent	50	1.60	1.58	1.56	1.60	1.66	1.77	1.80	1.81
	60	1.60	1.57	1.55	1.60	1.66	1.77	1.80	1.81
	70-100	1.58	1.56	1.54	1.59	1.65	1.76	1.79	1.80

North Aspect -- 30% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South	0	1.84	1.81	1.79	1.77	1.85	1.90	1.92	1.91
Aspect	10	1.80	1.77	1.75	1.77	1.82	1.87	1.89	1.88
%	20	1.76	1.74	1.71	1.74	1.79	1.84	1.86	1.87
Clearcut	30	1.72	1.70	1.67	1.71	1.76	1.83	1.86	1.87
or	40	1.68	1.66	1.64	1.69	1.74	1.83	1.86	1.87
Equivalent	50	1.64	1.62	1.61	1.66	1.73	1.83	1.86	1.87
	60	1.63	1.61	1.60	1.65	1.73	1.83	1.86	1.88
	70-100	1.62	1.59	1.59	1.64	1.72	1.83	1.86	1.88

INCHES OF STREAMFLOW FOR HIGHEST 6-DAY PERIOD FLOW PERIOD
30 INCHES PRECIPITATION ZONE

North Aspect -- 40% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South	0	1.87	1.85	1.83	1.85	1.90	1.95	1.97	1.96
Aspect	10	1.83	1.81	1.79	1.82	1.87	1.92	1.94	1.93
%	20	1.79	1.77	1.75	1.80	1.85	1.90	1.92	1.93
Clearcut	30	1.75	1.73	1.72	1.77	1.82	1.89	1.92	1.94
or	40	1.71	1.69	1.69	1.74	1.79	1.90	1.93	1.94
Equivalent	50	1.67	1.65	1.66	1.71	1.79	1.90	1.93	1.94
	60	1.67	1.64	1.65	1.70	1.79	1.90	1.93	1.94
	70-100	1.65	1.63	1.64	1.69	1.78	1.89	1.92	1.93

North Aspect -- 50% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South	0	1.91	1.88	1.86	1.91	1.96	2.01	2.02	2.01
Aspect	10	1.87	1.85	1.83	1.88	1.93	1.98	1.99	1.99
%	20	1.83	1.81	1.80	1.85	1.90	1.96	1.99	2.00
Clearcut	30	1.79	1.77	1.77	1.82	1.87	1.96	1.99	2.00
or	40	1.75	1.73	1.74	1.79	1.85	1.96	1.99	2.00
Equivalent	50	1.71	1.69	1.71	1.76	1.85	1.96	1.99	2.00
	60	1.70	1.6	1.71	1.76	1.85	1.96	1.99	2.00
	70-100	1.69	1.66	1.69	1.74	1.84	1.95	1.98	1.99

INCHES OF STREAMFLOW FOR HIGHEST 6-DAY PERIOD FLOW PERIOD
30 INCHES PRECIPITATION ZONE

North Aspect -- 60% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South	0	1.92	1.90	1.88	1.93	1.98	2.03	2.04	2.03
Aspect	10	1.88	1.86	1.85	1.90	1.95	2.00	2.01	2.02
%	20	1.84	1.82	1.84	1.87	1.92	1.98	2.01	2.02
Clearcut	30	1.80	1.78	1.82	1.84	1.89	1.98	2.01	2.02
or	40	1.76	1.74	1.76	1.81	1.87	1.98	2.01	2.02
Equiv-	50	1.72	1.70	1.73	1.78	1.88	1.98	2.01	2.03
alent	60	1.72	1.69	1.73	1.78	1.88	1.98	2.01	2.03
	70-100	1.70	1.68	1.71	1.76	1.87	1.98	2.01	2.02

North Aspect -- 70% Clearcut or Equivalent

		East or West Aspect -- % Clearcut or Equivalent							
		0	10	20	30	40	50	60	70-100
South	0	1.92	1.90	1.88	1.93	1.98	2.03	2.04	2.04
Aspect	10	1.88	1.86	1.85	1.90	1.95	2.00	2.02	2.03
%	20	1.84	1.82	1.82	1.87	1.92	1.99	2.02	2.03
Clearcut	30	1.80	1.78	1.88	1.84	1.89	1.99	2.02	2.03
or	40	1.76	1.74	1.77	1.81	1.88	1.99	2.02	2.03
Equiv-	50	1.72	1.70	1.74	1.79	1.88	1.99	2.02	2.03
alent	60	1.71	1.69	1.73	1.78	1.88	1.99	2.02	2.03
	70-100	1.70	1.68	1.72	1.77	1.88	1.98	2.02	2.03

C. DEFINING STREAMCOURSES

(From FSM 2526.05 R-6)

Stream -- A watercourse or section of a watercourse -- that has perennial flow, or that has intermittent flow.

Perennial Streams -- Normally flow yearlong, except during periods of extreme drought. Have well-defined channels and show signs of washing and scouring.

Intermittent Streams --

Carry water much of the year, but cease to flow during the dry season because evaporation and percolation into their bed and banks exceeds the available streamflow.

Have well-defined channels. Include channels showing active scouring or washing in this category even though they may flow only during or immediately after periods of precipitation or the melting of snow.

Normally lack litter, except during the fall of the year, indicating streamflow sufficient to move material during runoff.

Intermittent streams do not include ephemeral streams.

Ephemeral Streams --

Carry only surface runoff and flow only during and immediately after periods of precipitation or the melting of snow.

Form in slight depressions in the natural contour of the ground surface, but do not normally develop sufficient flow to wash or scour their channels.

Can usually be identified by the presence of needles or other litter in the depressions.

Stream Classification -- The present and foreseeable uses made of the water and the potential effects of on-site changes on downstream uses, are the criteria for defining four stream classes. The importance of use will be relative to the general locale. Size is not necessarily a criterion for classification. Classify whole streams or parts of streams. One stream may be sectionalized into several classes.

Class I -- Perennial or intermittent streams or segments thereof that have one or more of the following characteristics:

Direct source of water for domestic use (FSM 2543 - cities, recreation sites, and so forth.

Used by large numbers of fish for spawning, rearing or migration.

Flow enough water to be a major contributor to the quantity of water in a Class I stream.

Class II -- Perennial or intermittent streams or segments thereof that have one or both of the following characteristics:

Used by moderate though significant numbers of fish for spawning, rearing or migration.

Flow enough water to be a moderate or not clearly identifiable contributor to the quantity of water in a Class I stream, or be a major contributor to a Class II stream.

Class III -- All other perennial streams, or segments thereof not meeting higher class criteria.

Class IV. All other intermittent streams or segments thereof not meeting higher class criteria.

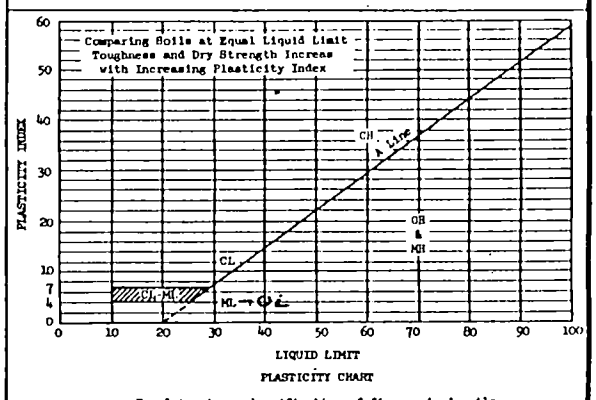
D. **UNIFIED SOIL GROUP CLASSIFICATION TABLE**

On the next page is a table to be used for determining GW and GP Unified soil groups.

Table I

UNIFIED SOIL CLASSIFICATION
(Including Identification and Description)

Major Divisions			Group Symbols	Typical Names	Field Identification Procedures (Excluding particles larger than 3 inches and basing fractions on estimated weights)			Information Required for Describing Soils	Laboratory Classification Criteria
1	2		3	4	5			6	7
Coarse-grained Soils: More than half of material is larger than No. 200 sieve size.	Gravels: More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics.	Determine percentages of gravel and sand from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows: Less than 5% GW, GP, SW, SP. More than 12% GM, GC, SM, SC. 5% to 12% Borderline cases requiring use of dual symbols.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.				
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).				
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification procedures see CL below).				
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size.	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.				$C_u = \frac{D_{60}}{D_{10}}$ Greater than 5; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3; Not meeting all gradation requirements for SW
			SP	Poorly-graded sands, gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			Example: Silty sand, gravelly; about 20% hard, angular gravel particles 1/2-in. maximum size; rounded and subangular sand grains coarse to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).	Atterberg limits below "A" line or PI less than 4; Atterberg limits above "A" line with PI greater than 7; Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).				$C_u = \frac{D_{60}}{D_{10}}$ Greater than 5; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3; Not meeting all gradation requirements for SW
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).				Atterberg limits below "A" line or PI less than 4; Atterberg limits above "A" line with PI greater than 7; Limits plotting in hatched zone with PI between 4 and 7 are borderline cases requiring use of dual symbols.
Fine-grained Soils: More than half of material is smaller than No. 200 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.					Identification Procedures on Fraction Smaller than No. 40 Sieve Size				Use grain-size curve in identifying the fractions as given under field identification.
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)		
	Silts and Clays: Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None	Give typical name, indicate degree and character of plasticity, amount and maximum size of coarse grains, color in wet condition, odo if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses.	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium		
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight		
	Silts and Clays: Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions.	
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High		
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium	Example: Clayey silt, brown, slightly plastic, small percentage of fine sand, numerous vertical root holes, firm and dry in place, loess, (ML).	
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.				



PLASTICITY CHART

For laboratory classification of fine-grained soils

(1) Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder. (2) All sieve sizes on this chart are U. S. standard.

FIELD IDENTIFICATION PROCEDURES FOR FINE-GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus No. 40 sieve size particles, approximately 1/64 in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (Reaction to shaking)

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics)

After removing particles larger than No. 40 sieve size, mold a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun, or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength; Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit)

After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size, is molded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eighth inch in diameter. The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

E. RATIONALE FOR SURFACE CROSS-DRAIN GUIDE

The spacing criteria are an adaptation of "Guides for Controlling Sediment from Secondary Logging Roads", R-1 and R-4, 1964. This 1964 guide is based on research conducted on similar soils and climate on the Nez Perce and Payette National Forests.

A one inch deep eroded rill was used as the criteria for determining when a road needed a surface cross-drain to keep the rill from eroding deeper. The one inch criteria and the associated spacing guide is thus meant to substantially satisfy FSH 7709.11, 24.43, R-6 direction. This states that "The primary purpose of a drainage dip (surface cross-drain) is to intercept and remove surface water from the travelled way and shoulders before the combination of water volume and velocity begins [one inch approximately qualifies] to displace the surface materials".

Insloping or outsloping on non-crushed rock roads is, alone, not an effective solution for preventing rilling. Rills in the form of wheel ruts usually form on limited strength roads during just one vehicle pass during wet surface conditions, and on pitrun roads after just a year or so. Maintenance cannot be depended upon to remove ruts soon after formation. **The Management Practice requiring use of this guide has been elevated to a Management Practice or "must" Design Standard because there is no other known guide that would be as cost-effective for use on the Wallowa-Whitman.**

F. WATERSHED MANAGEMENT RECOMMENDATIONS FOR FIRE SALVAGE OPERATIONS

Watershed Objectives / Issues and concerns:

The overall fire salvage sale objective should be to harvest as much merchantable fire killed or damaged trees in a cost efficient manner while at the same time not significantly increasing erosion potentials over fire induced potentials.

General Recommendations:

1. Concentrate salvage operations in the moderate and low intensity burn areas. These areas are more hydrologically stable due to better ground and canopy cover conditions.

2. Utilize a take some leave some approach. Material currently on the ground should be left for its' sediment trapping and site productivity enhancement properties.

3. Design salvage sale units so that harvest system capabilities are not exceeded and watershed values are protected.

Ground Based Harvest Systems:

1. Limit ground based skidding to slopes less than 30%.

2. Winter log over a minimum of 2' of snow or 4-6" of frozen ground. **Frozen ground is the preferred method of operation.**

3. Utilize a skid trail network with a minimum of 100' spacing between trails.

4. Single pass off trail skidding on over snow or frozen ground conditions.

5. When more than 50 feet of 4" ruts develop, skidders should switch to another trail. If more than 10% of the trails become rutted, shut down operations.

6. Rehabilitate all skid trails.

7. Erosion proof, by waterbarring and seeding, all salvage-induced exposed soil areas.

8. Lop and scatter slash throughout the unit. The objective is to provide additional ground cover within moderate and high intensity burn areas.

Cable Harvest Systems:

1. Maintain full suspension of logs on high intensity burn areas.

2. Avoid blind leads.

3. In cable corridors, lateral endhaul areas or other areas where full suspension is not maintained waterbars may be necessary and all ground disturbed from yarding operation should be reseeded.

4. Lop and scatter slash throughout the unit. Landing slash could be yarded back into the unit. The objective is to provide additional ground cover within moderate and high intensity burn areas.

All Systems:

1. Fall trees along the contour to alleviate potential drainage problems and to maintain slope stability.

2. Avoid falling trees in drainageways (all live streams and ephemeral draws).

3. Contour fall snags and other noncommercial material to provide sediment traps on the slopes.

4. Leave as much slash as possible in the units.

G. WATERSHED KV PROJECTS LIST

When evaluating potential watershed projects, estimate what the natural recovery rate might be and determine whether this is acceptable. If unacceptable, then consider what level of management induced improvements will be necessary to speed up the natural recovery process. Management induced improvements may include silvicultural prescription and road management modifications.

A rule of thumb to consider is that if natural improvement will take longer than 10 years (25-50 years is the typical period for natural vegetative recovery and rehabilitation) then, depending on the value of the resources, consider speeding up the natural processes by a watershed treatment. The decision on which route to take will be : Cost Effectiveness vs Benefits Received.

Road Maintenance -- Fix road drainage problems near streams with FR&T maintenance funds for open roads, KV or 092 funds for abandoned or non-system roads.

Road Obliteration -- This project usually involves subsoiling of the roadbed, pulling culverts, seeding and fertilizing, and waterbarring where necessary. The Objective of road obliteration can be to put the land back into vegetative production and/or to eliminate identified sediment point sources which originate on the road system. Road obliteration is limited to non-system roads.

Trail Rehabilitation: Provide drainage and erosion control on a trail system.

Other Erosion Control Activities: This work can include meadow restoration, streambank stability work and hillslope stability work. The objectives would be for site productivity protection/restoration, maintenance of water quality/ fishery habitat, and/or protection of investments. Typical activities include:

- -- Fencing for protection of project improvements. If appropriate, assign fencing costs to damaging agent(s) -- permittee, wildlife, recreation etc..

- -- Construction of check dams. These may be wooden or wire cage check dams or vegetative debris where appropriate.

- -- Streambank stabilizing projects -- use of deflector logs, pulling back vertical banks, removing debris jams or improvements in upland watershed conditions to minimize stream channel changes. Use of in-steam check dams.

- -- Restoration of deteriorated meadows -- pulling back vertical banks, using water resistant cloth to protect banks and raise the local watertable. Planting of shrubs, willow, grasses and forbs to protect and enhance the riparian zone.

- -- Mechanical site preparation to restore or improve site productivity on skid roads and ORV trails -- may include contour subsoiling, disking seeding and/or fertilizing.

- -- Felling of trees to block cattle access in an area.

- -- Felling of trees in stream channels for fish habitat enhancement.

-- Mine restoration including slope stability projects, water and/or soil acid leachate neutralization, channelization and stabilization work in mine tailings, sediment dams or other water filtering projects.

Additional- Appropriate KV Projects

Soils and Watershed:

1. Waterbar and/or close roads road obliteration - subsoiling.
2. Construct gully plugs.
3. Contour furrowing.
4. Water quality monitoring of KV prjt
5. Riparian protection.
6. Rip-rap.
7. Debris removal from streams.
8. Enhance soil productivity.
9. Revegetate or alter vegetation.
10. Fertilization projects.
11. Administrative study of soil movement.
12. Monitoring sedimentation changes.
13. Erosion prevention, stabilization.
14. Stream flow deflectors.
15. Riparian rehabilitation.

Range:

1. Fertilize, seed and improve range species.
2. Build barrier fences.
3. Water developments, troughs, spring boxes.
4. Restore livestock trails through slash.
5. Thin vegetation.
6. Prescribed burning-within sale area.
7. Noxious weed control
8. Brush control.
9. Remove trees encroaching on meadows.
10. Administrative study of changes in forage productivity after logging.
11. Construction of corral or holding pens.
12. Monitoring the effectiveness of barriers.
13. Install gates and stiles.
14. Install water gap or improve crossing stock driveway.

Fisheries:

1. Construct fish ladders.
2. Stream improvement structures
3. Cover structures.
4. Aquatic weed control.
5. Barrier removal.
6. Migration or species barrier construction.
7. Pool creation.
8. Riparian rehabilitation.
9. Artificially undercutting of banks - habitat creation.
10. Replacement of barrier culvert.
11. Fishing visitor parking, gates, signs.
12. Fishing trails.
13. Artificial spawning area.
14. Fish or prey species change.
15. Bank stabilization.
16. Flow deflectors.
17. Stream surveys.
18. Monitoring water quality.
19. Habitat access control.

U.S.D.A. - Forest Service

COMPUTATION OF EROSION HAZARD RATING (EHR)

(Instructions on Reverse)

Project _____ By _____

Location No. _____ Date _____

Computation of Values for Each Factor

Factor	Description	Characteristics - Weighting Guide			Assigned Value	Computation of Erosion Hazard Rating	Alternative Methods 1/	
1. SOIL	a. Detachability Detachability value (a) = ___ Coarse fragments	Strongly resistant (1), (2), (3), or (4)	Moderately resistant (6), (7), or (8) on surface (R) = ___%	Weakly resistant (10), (11), or (12) a - (aR) =		Factor Rating: 4 to 14 = 1 15 to 20 = 2 21 to 24 = 3 25 to 33 = 4 Assigned Rating		
	b. Infiltration of surface horizon.	Rapid (1), (2) or (3)	Moderate (4), (5), or (6)	Slow (7), (8), or (9)				
	c. Permeability of lower horizon	Rapid (1) or (2)	Moderate (3) or (4)	Slow (5) or (6)				
	d. Depth at which permeability reduction begins	36"+ to 18" (1) or (2)	17" to 6" (3) or (4)	Less than 6" (5) or (6)				
				TOTAL				
2. TOPO-GRAPHY	a. Slope of area being classified	0 to 30% (0), (1), or (2)	31 to 50% (4), (5), or(6)	51 to 70%+ (8), (9), or (10)		Factor Rating: 2 to 5 = 1 6 to 9 = 2 10 to 16 = 3 Assigned Rating		
	b. Uniformity of slope being classified	Flats or mounds cover 50% of area (1)	Flats or mounds cover 10 to 50% of area (2)	Flats or mounds cover 10% or less of area (3)				
	c. Water concentration potential	Low (1)	Moderate (2)	High (3)				
				TOTAL				
3. CLIMATE	a. Distribution of annual precipitation	Well distributed (1) or (2)	Some irregularity (3) or (4)	Irregularly distributed		Factor Rating: 4 to 10 = 1 11 to 19 = 2 20 to 28 = 3 Assigned Rating		
	b. Rainfall intensities	Low (1), (2), or (3)	Moderate (4), (5), (6), or (7)	High (8), (9), or (10)				
	c. Snow	None, or slow to melt (1) or (2)	Melts at moderate rates (3) or (4)	Melts rapidly (5) or (6)				
	d. Soil temperatures	Seldom below freezing (1) or (2)	Often below freezing (3) or (4)	Usually below freezing (5) or (6)				
				TOTAL				
4. COVER	a. Density of living vegetation after disturbance	100 to 70% (1) or (2)	69 to 30% (3), (4), or (5)	29 to 0% (6) or (7)		Factor Rating: 2 to 5 = 1 6 to 10 = 2 11 to 17 = 3 Assigned Rating		
	b. Ground cover density (e.g., litter)	100 to 70% (1), (2), or (3)	69 to 30% (4), (5), (6), or (7)	29 to 0% (8), (9), or (10)				
				TOTAL				

EROSION HAZARD

Rating Total	Hazard
4 - 5	Low
6 - 8	Moderate
9 - 10	High
11 - 13	Very High

5. SUPPLEMENTAL RATING

G - Gully erosion hazard (add 2 to Rating Total)

RATING TOTAL			
SUPPLEMENTAL RATING			
NET EROSION HAZARD			

REMARKS:

1/ Alternative methods for performing the activity may result in different EHR's. These alternatives should be considered and briefly described.

GENERAL INSTRUCTIONS

The erosion hazard rating for an area is determined in five steps. Values are recorded in appropriate blocks on Form RS-2500-14.

Step 1. Assign weighted values to individual characteristics of each factor: soil, slope, climate and cover. The range in values shown under each characteristic permits weighting for intermediate conditions.

Step 2. Total the assigned values.

Step 3. Using the range of assigned values for each factor, determine the rating for each factor.

Step 4. Add the four factor ratings to compute the erosion hazard rating.

Step 5. Add supplemental ratings for gully erosion hazard on unstable terrain if appropriate.

FACTORS

1. Soil

a. Detachability - Use detachability key.

b. Infiltration - an estimate of the rate at which water moves into the soil. Generally related to texture, but may be reduced by compaction, puddling, etc.

Rapid. Sands, loamy sands and sandy loams; generally very open and porous (1,2 or 3).
Moderate. Gravelly loams, loams and silt loams generally somewhat open and porous. Also includes the more open and porous soils of finer textures, and the less porous soils of coarser textures (4,5 or 6).
Slow. Clay loams and clays; generally with few large pores and openings. Also includes any coarser textured soils which have very few pores and openings (e.g., soils compacted by grazing) (7,8 or 9).

c. Permeability - an estimate of the rate at which water moves down through the soil. Lower horizon is any horizon below the surface horizon. The objective is to determine if the permeability of the lower horizon is the same as or different from the infiltration of the surface horizon.

Rapid. Sands, loamy sands, and sandy loams; generally very open and porous (1 or 2).
Moderate. Gravelly loams, loams, and silt loams; generally somewhat open and porous. Also includes the more open and porous soils of finer textures, and the less porous soils of coarser textures (3 or 4).

Slow. Clay loams and clays; generally with few large pores and openings. Also includes any coarser textured soils which have very few pores and openings. (5 or 6)

d. Depth - Measure depth from soil surface to any restricting layer which might occur within three feet. This could be unweathered or weathered bedrock, a hardpan, or (more commonly) a horizon of clay accumulation which is at least one textural class finer than the surface horizon; (e.g., a change from sandy loam to loam or clay loam).

2. Topography

a. Slope - Determine gradient of slope in percent. In broken topography, use the average or more dominant slope, whichever will give the most representative figure. The weighting factor should be increased by one for each ten percent increase in gradient.

b. Uniformity - In broken topography, runoff water tends to spread out and lose velocity and carrying capacity. Flats or rounded breaks up to one-half acre in size should be considered.

c. Water Concentration - If slopes above the area considered are likely to contribute surface flow, or if the planned disturbing activity may concentrate water; (e.g., road drainage or skid trails), these factors add to the erosion hazard.

3. Climate

a. Distribution -

Well distributed. Precipitation can be expected in varying amounts throughout most of the year. No more than 20 percent of total annual precipitation falls in any one month.

Average annual precipitation less than 30".....(1)
Average annual precipitation 30" or more .....(2)

Some irregularity. Precipitation normally occurs within a 6 to 8 month period, principally in the late fall, winter, and early spring, with a few occasional summer showers. Precipitation in any one month does not exceed 40 percent of total annual precipitation.

Average annual precipitation less than 30" .....(3)
Average annual precipitation 30" or more .....(4)

Irregularly distributed. Precipitation is usually confined to one season of the year, with 40 percent or more of the total annual precipitation often falling in any one month.

Average annual precipitation less than 30" .....(5)
Average annual precipitation 30" or more .....(6)

b. Intensity - Soil moisture conditions usually prevalent before storms should be used as a guide to assigning weighted values within each intensity class. The drier the soil before storms, the lower the value. For example, if high intensity storms usually occur during the summer months when the soils are dry, a rating of (8) would be used; however, if high intensity storms usually occur during the winter month when soils are at or near field capacity, the maximum rating of (10) would be used.

4. Cover

a. Density of Living Vegetation - Refers to all living herbaceous and woody vegetation (overstory or understory) expressed as percent of ground covered, as seen from the overhead view. Multi-storied vegetation is considered as only one story; (i.e., maximum cover percentage is 100%). Deciduous species are evaluated with normal summer leaf cover on the assumption that leaf fall will provide similar cover protection during the dormant season.

b. Ground Cover Density - Refers to normal litter or duff, slash, bulldozed brush, down logs, dead standing woody vegetation, and all residue following fire, clearing, logging, or other disturbing activity (e.g., root crowns, exposed roots, stubble leaves twigs).

5. Supplemental Rating

Soils Susceptible to Gully Erosion-

Symbol	Soil Characteristics
G	Soils, with sandy or loamy surface horizons, derived from granitic rocks, volcanic ash, or recent alluvium and any other soils where present conditions indicate the soils are extremely susceptible to deep gullying by concentrated flows of water. (Deep gullying= 2 feet to many feet deep)

SOIL DETACHABILITY KEY

I. Surface soil is a sand, with little or no aggregation. It exists as a single grains of mineral sands less than 2 mm. in size in an already detached state. It starts flowing immediately when wetted. (Non-resistant) .....(12)

II. More or less aggregation of soil particles apparent, with some degree of resistance to flowing when wetted.

A. Surface soil aggregates collapse when first moistened.

(Weakly resistant)

1. When washed with a fine stream of water, the flow is mostly muddy water composed of very small particles much less than 1 mm in size.....(11)

2. When washed, flow is muddy water, but with many sand (mineral) particles, or tiny aggregates of soil material which do not melt (disperse) on wetting, and are generally less than 1 mm in size....(10)

B. Surface soil aggregates do not collapse when first moistened.

1. When washed only a few times with a fine stream of water, many of the aggregates melt or become detached and wash away as muddy water. (Moderately resistant)

a. Dispersion of aggregates is essentially complete. Mostly muddy water composed of very small particles much less than 1 mm in size.....(8)

b. Dispersion incomplete. Some resistant aggregates remain after washing.

Flow is muddy water with many sand particles or tiny aggregates of soil material which do not melt on wetting, and are generally less than 1 mm in size.....(7)

Same as above but sand grains or aggregates are generally 1-2 mm in size.....(6)

2. Surface soil aggregates not only do not collapse when first moistened, but require repeated washing to cause collapse or any appreciable muddying of the wash water. (Strongly resistant)

a. Resistant soil aggregates are dominantly less than 2 mm in size.

Aggregates eventually melt with repeated washing.....(4)

Aggregates do not melt, even with repeated washing.....(3)

b. Resistant soil aggregates are dominantly larger than 2 mm in size.

Aggregates eventually melt with repeated washing.....(2)

Aggregates do not melt, even with repeated washing.....(1)

Soil detachability is modified by any coarse rock fragments (1/2 inch in diameter and larger) on the surface. These reduce both the detaching force of raindrop impacts and the velocity of surface flows of water.

Procedure:

1. Record assigned detachability value on the form in the space following (A).

2. Make an ocular estimate of the percentage of coarse fragments which will be on the soil surface after disturbance (gravels and stones larger than 1/2 inch in diameter), and insert in the space following (B).

3. Using the simple formula provided, compute the adjusted detachability value. Example: (A) = 8, (B) = 10%, A-(AxB) = 8 - (8 x 0.1) = 8 - 0.8 = 7.2. Round this off to a detachability value of 7 and enter this figure in the column "Assigned Value".

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